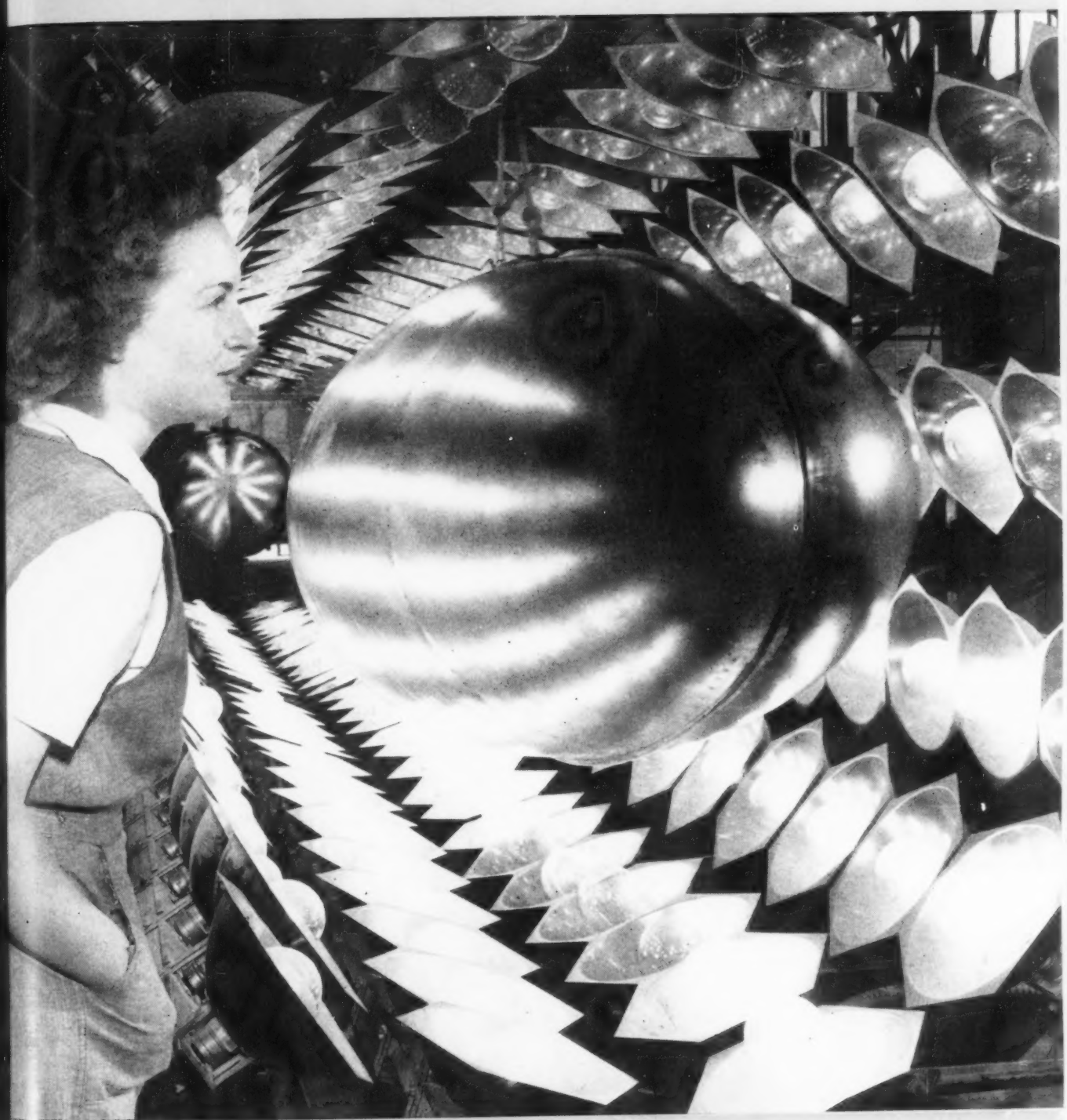
ELECTRICAL WEST

SPOKESMAN FOR THE MOST HIGHLY ELECTRIFIED SECTION OF THE U. S.



...aw-Hill Co.
...California

AUGUST 1945

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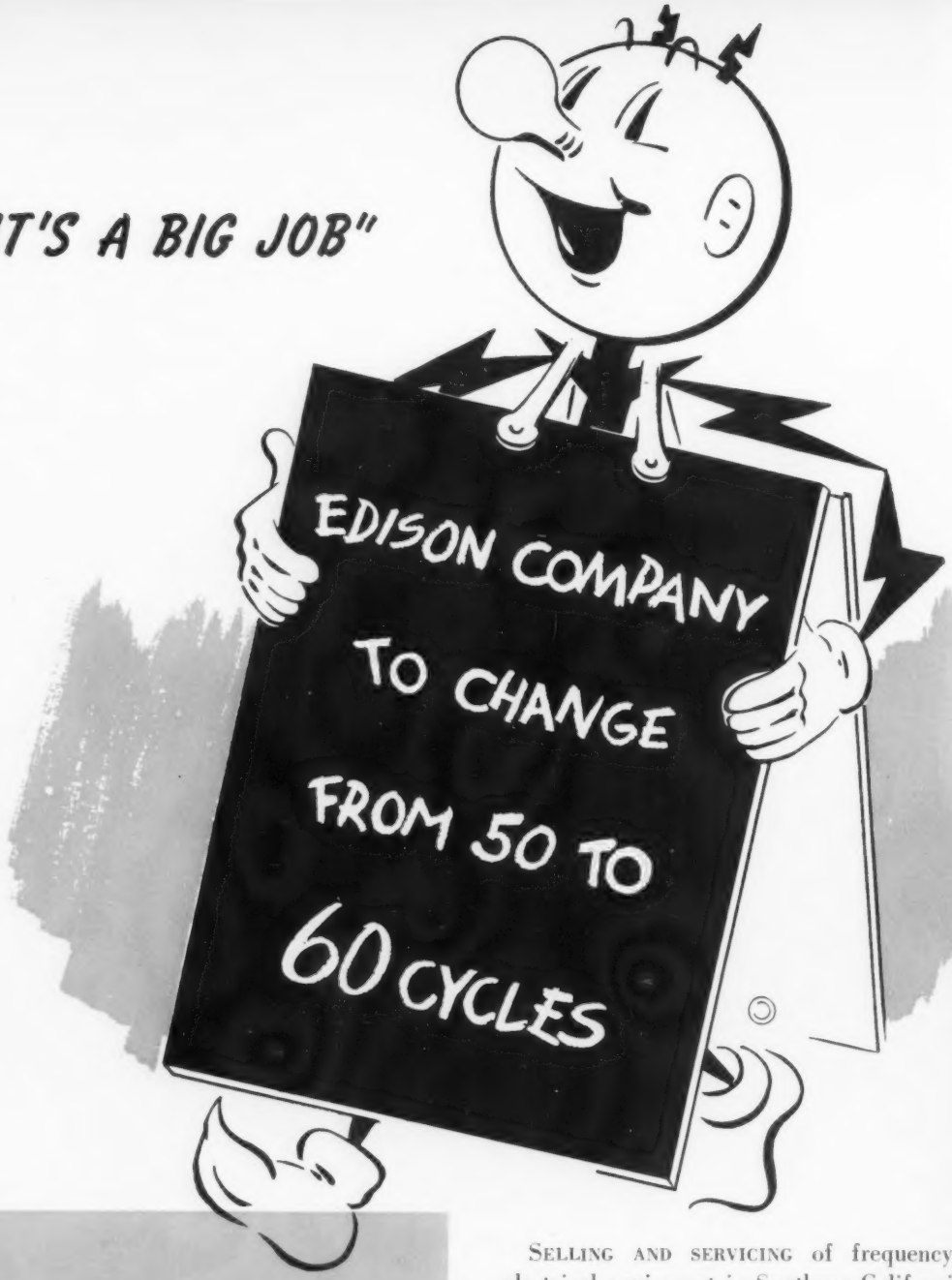
"IT'S A BIG JOB"



GETTING SET FOR BETTER POSTWAR SERVICE

SELLING AND SERVICING of frequency-sensit electrical equipment in Southern California will simplified when the Edison Company's freque change is completed. A further benefit to the dustry will result from the availability of ene interchangeable among all power systems in C fornia, southern Nevada and western Arizona wi out using frequency changers.

Changing to 60 cycle service in all territory n served at 50 cycles is one of the Edison Compan most important postwar plans. It includes all of company's territory except the San Joaquin Vall which now is served at 60 cycles.

Much planning and preparation will be requi before physical work on this project can begin. the required materials and labor are available, physical work probably will begin in late 1946 a every effort will be made to complete the job soon as possible.

ELECTRICAL WEST (with which is consolidated The Journal of Electricity), August, 1945. Vol. 95, No. 2. Published monthly by the McGraw-Hill Company of California, 68 Post Street, San Francisco, 4, Calif. Entered as second class matter at the post office at San Francisco under the Act of March 3, 1879. Additional entry as second class matter at the post office at Los Angeles. Printed in U. S. A. Subscription rates—U.S. U.S. Possessions and Latin American Republics: $2, 1 year; $3, 2 years; $4, 3 years. Canada: $2.50, 1 year; $4, 2 years; $5, 3 years. Other countries: $3, 1 year; $5, 2 years; $6, 3 years. Single copy, 25c. Copyright, 1945. McGraw-Hill Company of California. All rights reserved.

SAVE MAN-HOURS BY TESTING WATTHOUR METERS *Electronically*

Practically eliminates testing error—accurate to 4/1000 of one per cent in one revolution of the meter disk. Superior to any nonautomatic method.

● More than three years' experience in the field has proved that this G-E photoelectric watthour-meter tester—an electronic device—offers two fundamental advantages: saving in testing time and improved accuracy.

The accuracy of this testing equipment makes long running time unnecessary. Five revolutions of both the service meter and the standard are sufficient for full-load tests; one revolution of the service meter and five of the standard for light-load test. These running times are approximately one-half those of the old non-automatic testing procedure. Repeat runs, to confirm the accuracy of the first reading, are unnecessary. Furthermore, since the meter does not have to be watched during the test run, operators are free to do other work.

If you want more facts about this photoelectric watthour-meter tester—how it works, how it reduces running time, how you can plan savings in test procedure, and how the photoelectric method compares with the old nonautomatic—write for Booklet GEA-3348A. *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

WATTHOUR METERS

HEADQUARTERS FOR ELECTRICAL MEASUREMENT

ELECTRICAL WEST

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Cover photo: In one of the West's largest infrared tunnels, at Weber Show Case Co. in Los Angeles, die stamped drop-off fuel tanks for aircraft ride through on a conveyor. The infrared sets the interior tank lining and bakes on the burnished exterior coat of lacquer.

CHANGE OF ADDRESS

Circulation Manager,
Electrical West,
68 Post St.,
San Francisco 4, Calif.

Please change my address

From .....

To .....

Signed .....

People

O. R. Hartwig is in charge of safety and industrial relations at Crown-Zellerbach's big paper mills near Portland. He has learned people, climbing up from apprentice to plumber, to union business agent and plumbers association secretary to safety engineer and personnel man. What he tells of getting along with people is straight psychology phrased in ordinary English. (See p. 57)

C. A. Rowley has often spoken in ELECTRICAL WEST, usually on wiring adequacy. He has been an electrical contractor who believed in wiring adequacy, taught it to architects. Now he is electrical engineer at Thermador, since 1937, where he envisages a big future for home electrification. However, when war came, he, like his company, had to drop appliances and learn war production. What they both learned about electric welding can be of benefit to all in the industry. (p. 77)

G. N. Hawley too is no stranger to ELECTRICAL WEST readers. He heads industrial power and commercial sales for Southern California Edison. That power salesmen are expected to know everything about anything he found out when he was one himself. One way to live up to that reputation seems to be conference training. (p. 69)

Preview

Lighting Issue

Timed to the opening of the fall and winter season, the next ELECTRICAL WEST will contain useful and thought-provoking information on lighting of all kinds.

TOOLS

From pliers to pike poles — clamps to cable cars — tree trimmers to tamping bars, Graybar offers first-quality tools for every power line job. These tools are designed specifically to help linemen do the best work with the greatest safety. Special tools are available for hot-line jobs.

By making Graybar your headquarters not only for tools — but for hardware, poles, crossarms, strand, insulators, pins, and accessories — you will always be sure of getting the right materials for each job. *Graybar Electric Company, Graybar Building, New York 17. N. Y.* 4535

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IN OVER 80 PRINCIPAL CITIES

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. . . . I'd certainly have this Monarch Electric Roaster Range in my post-war line. The built-in roaster is such a wonderful feature that I can't imagine any woman buying any other range once she knows about all the advantages of having an auxiliary oven like this built right into the cooking top."

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. . . high domed cover to increase roaster depth
. . . for juicy, tender roasts
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IF IT'S A ROASTER RANGE - IT'S A MONARCH

COAL-WOOD, ELECTRIC, GAS and COMBINATION RANGES

Write for exclusive Monarch franchise particulars.

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NOW.. the new Stratoliner series with .. or without a Germicidal unit

ANOTHER LEADER FIRST.. INCORPORATES EVERY KNOWN FEATURE OF ADAPTABILITY FOR INDUSTRIAL LIGHTING, A HEAVY DUTY QUALITY UNIT.

Provision for a Germicidal Unit for immediate or future installation.

Simple and efficient hanging arrangements.

Individual or continuous row installations easily installed by carefully worked out accessories.

Four, eight and ten foot channels of one piece construction with a reinforcing bead to add rigidity and grip support for sliding clamp hangers.

Blank section to provide for future lighting requirements.

Two light sections or three light sections incorporated with blank sections in order to meet made to order lighting plans.

LEADER NO. GK 115 GERMICIDAL KITS are easily installed on Stratoliner units. Available at small extra cost, they contribute greatly to the health and efficiency of personnel. Knockouts are provided on Stratoliner Channel, if ordered, for immediate or subsequent installation of Leader Germicidal Kit.

LEADER ELECTRIC MANUFACTURING CORP.

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WEST COAST FACTORY: 2040 LEVINGSTON STREET · OAKLAND 6, CALIFORNIA

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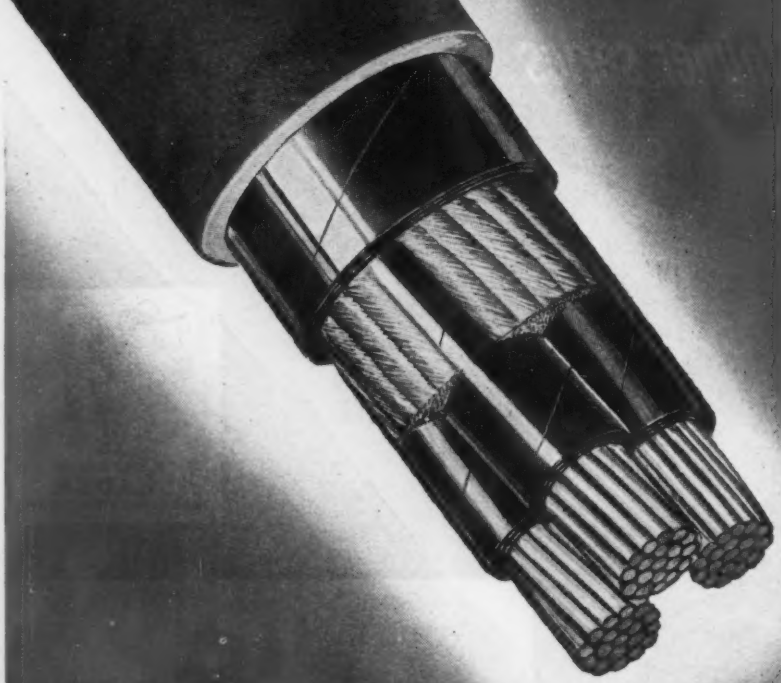

Heavier loads for longer periods of time than formerly possible are obtainable with CRESCENT VARNISHED CAMBRIC CABLE, due to substantial improvements in high temperature varnished cambric tapes. This general-purpose, industrial power cable provides higher current carrying capacity for the same size of copper conductors, together with maximum safety and permanence.

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BOOKS
you may want

MARINE ELECTRICIANS' LIBRARY, by John M. Dodds, field application engineer, General Electric Co., San Francisco, McGraw-Hill Book Co., in three volumes: ELECTRICAL ESSENTIALS IN MARINE SERVICE—Vol. I, $3; ELECTRICAL POWER SOURCES IN MARINE SERVICE—Vol. II, $4; ELECTRICAL POWER USES IN MARINE SERVICE—Vol. III, $4.

John Dodds has been teaching classes of marine electricians under the war training program. So well organized was the material and so clear and simple the presentation that he was asked to put the subject into a book. When he started work on this it developed into three volumes with the supporting information and data to make it fully useful to the practical electrician. Thus practically without any further text or reference books these volumes serve the marine electrician in the various types of work in which he is involved. The books are designed not only for the shipyard electrician but for the seagoing one who must maintain and operate the electrical equipment in the greatly expanded number of Merchant Marine and Navy vessels which have been built during the war.

The first volume on electrical essentials starts properly with a mathematics review and a physics and mechanics review. It goes then into generation and the electrical circuits and an introduction to the analysis of alternating-current circuits and transformers. There follows application and installation of shipboard cable and marine telephone and communication devices.

In the second volume on power sources the contents start with the electrical machine itself, then the construction and characteristics of alternating-current generators and of direct-current generators. There follows a section on operation and management of storage batteries and then considerable detail on circuit breakers, switches, relays, resistors, regulators, governors and other electrical devices and a final chapter on switchboards, meters and instruments.

The third volume on power uses, recently come from the press, goes into lighting and treats of the incandescent lamps and other modern lamp sources, the various new lamps for shore plant and marine use, searchlights, mercury vapor lamps, fluorescent lamps. Then another section discusses electrical propulsion of ships both direct current for relatively small power plants and alternating current for larger ship propulsion.

PRINCIPLES OF RADIO, by Keith Henney, fifth edition, 522 pages, 5½ x 8, John Wiley & Sons, $3.50.

This book has been widely used by students for the past 15 years and has recently been revised and enlarged. Over one-third of the new book deals with a-c and d-c theory starting from the fundamental concepts. This is followed by fundamental vacuum tube and circuit theory dealing with amplifiers, detectors, oscillators and receiver circuits. A chapter is devoted to antennas, transmission lines and radiation. Three final chapters are concerned with frequency modulation, ultra-high frequency technique, and electronic instruments such as vacuum tube voltmeters and cathode ray oscilliscopes.

Problems and examples are interspersed throughout the book to give the student the

(Continued on Page 12)

For easier reconversion to peacetime loads, install CSP distribution transformers now!

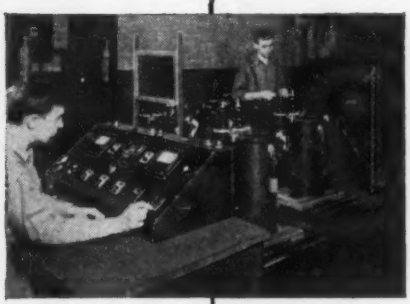
Twenty-four hours a day, CSP distribution transformers are on guard... ready to warn of approaching overloads. Completely Self-Protecting, these transformers give you economical adaptability to future load increases... which, according to all predictions, will be tremendous. They protect your investment and avoid the need for providing excessive capacity.

When the loads grow into overloads, the CSP signal light will flash its warning. And then you have only a single, self-contained unit to change.

For complete information on these transformers that are becoming a national standard, call your nearest Westinghouse office and ask for a copy of Descriptive Data 46-100. Or write for it, to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-70440

AN ENGINEER **ON THE JOB**

COULDN'T DO BETTER

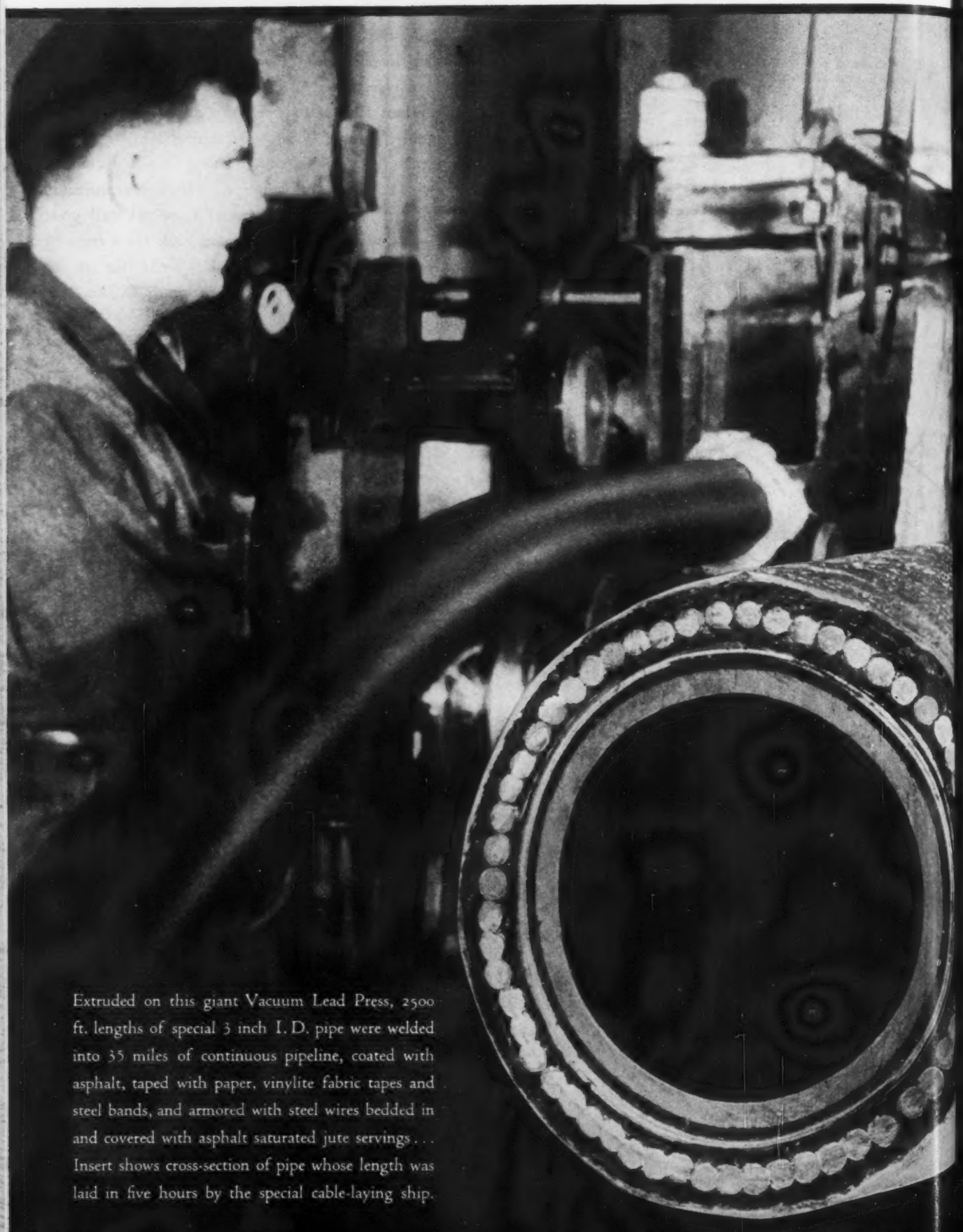


Every Westinghouse CSP transformer must pass ten severe tests that prove its ability to stand up in service. A direct stroke lightning test, for instance, is given to every one. Also high frequency coil test, and "De-ion" arrester, high current surge test. These are in addition to all the regular tests normally required by standardization bodies.

Westinghouse
PLANTS IN 25 CITIES .. OFFICES EVERYWHERE

CSP DISTRIBUTION TRANSFORMERS

A PIPE DREAM



Extruded on this giant Vacuum Lead Press, 2500 ft. lengths of special 3 inch I. D. pipe were welded into 35 miles of continuous pipeline, coated with asphalt, taped with paper, vinylite fabric tapes and steel bands, and armored with steel wires bedded in and covered with asphalt saturated jute servings... Insert shows cross-section of pipe whose length was laid in five hours by the special cable-laying ship.

COME TRUE . . .

With the active interest of General Eisenhower, and Allied officers, Admiral Lord Louis Mountbatten conceived a series of pipelines under the English Channel to feed precious oil and gasoline to Allied fighting forces speeding across France, Belgium, Luxembourg and Germany.

Experience in making the largest submarine electric-power cables enabled General Cable to volunteer undertaking its part of this important contract with its own existing facilities. General Cable quickly started making this continuous 35-mile pipe, thanks to available equipment commandeered from its coast-to-coast plants, its wealth of research and engineering talent, plus dogged determination to speed Victory. In about nine months from installation, the under sea traffic fuel from England to the continent via channel pipelines had totalled 120,000,000 gallons, freeing oil tankers, cars and other transport for more vital duties. With public recording of this secret comes the buoyant feeling that dreams do come true and many more, as yet unrevealed, will foster progress in a peace we all can share.

GENERAL CABLE CORPORATION

General Cable Corporation Sales Offices are located at Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Houston, Kansas City (Mo.), Los Angeles, New York, Philadelphia, Pittsburgh, Rome (N.Y.), St. Louis, San Francisco, Seattle, Washington (D. C.)

LOOK AT THE FEEDER REGULATOR SCORE

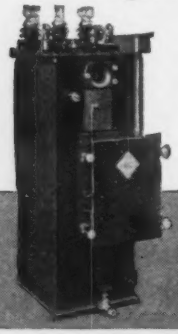
From the charts below, learn the reasons why more and more utility men are finding 5/8% Step Regulators the logical choice for regulation of 2400 v. feeders

REGULATORS ➡	Induction-Type	Allis-Chalmers 5/8% Step
Low Exciting Current?	NO Three times that of Step Regulator.	YES A third that of Induction Regulator.
Quiet Operation?	NO Core slots, rotor bearings, air gap may cause noise.	YES Regulator has no more audio noise than equivalent transformer.
Flexibility of Current Rating?	NO Gives ±10% regulation at rated current and ±5% regulation at double the current value.	YES A-C regulator gives ±10% regulation at rated current, and ±8¾%, 7½%, 6¼% and 5% regulation at higher currents.
Holding Coil Adjustments Eliminated?	NO	YES
Close Regulation?	YES Voltage held within 1% (1 volt). Motor tends to overshoot, making perfect regulation difficult.	YES Voltage held within ¾ volt by 5/8% step regulation with Feather-Touch control.

THE FACTS are simple: For low voltage feeder regulation, the Allis-Chalmers 5/8% Step Regulator saves you money — it's easy to calculate dollar economy — and in addition, it gives you the *best regulation* obtainable today.

Verify the facts for yourself by glancing at the charts on this page. Note especially that the Step Regulator requires only *one-third* the exciting current of induction regulators!

When a utility makes an impartial comparison of regulators, the 5/8% Step Regulator is nearly always selected for low voltage service... this has been Allis-Chalmers' experience.



To get the full story on economical Step Regulators *for all voltages*, call on our nearby district office, or write for Bulletins B6056A and B6065. ALLIS-CHALMERS, MILWAUKEE, WISCONSIN. A 1838

STEP REGULATOR ECONOMY CHART		
2400 VOLT REGULATOR RATING	POWER SAVINGS	AVERAGE DOLLAR SAVINGS
36 kva	6.1 kva	$ 37
48 kva	8.1 kva	$ 49
60 kva	10.2 kva	$ 61
72 kva	12.2 kva	$ 73
96 kva	16.3 kva	$ 98
120 kva	20.4 kva	$122

ALLIS-CHALMERS 5/8% STEP REGULATORS

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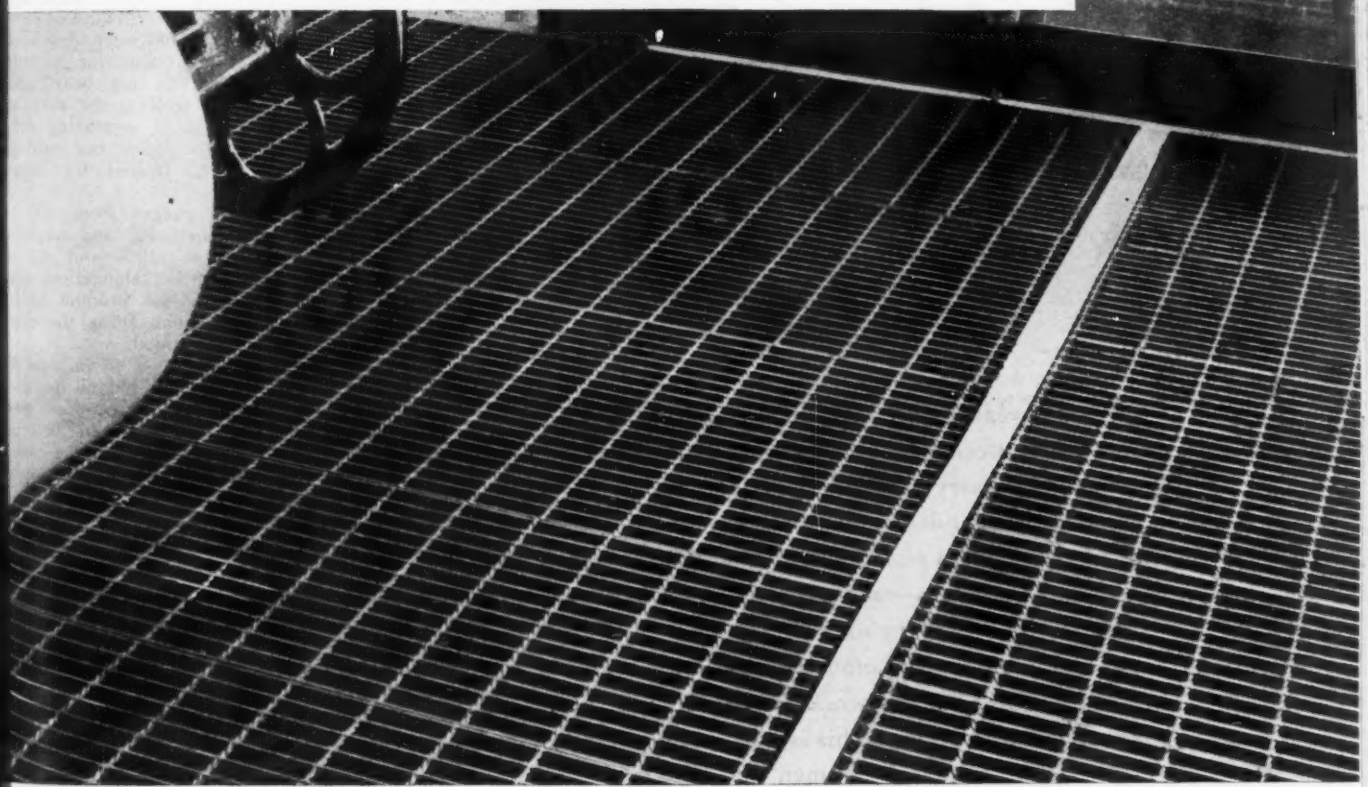
ON A SECURE FOOTING!

Give a man a footing he can trust . . . and he'll do a better job with greater safety. Blaw-Knox non-slip Electroforged Steel Grating is today giving surefooted protection to crews of merchantmen and freight trains, to workers in plants everywhere, to fighting men crossing bridges hastily thrown over rivers by our army engineers. In Stair Tread, Flooring, Catwalks, Running Boards, in dozens of other places . . . the twisted bar, one-piece self-cleaning construction gives strength and safety in any weather.

BLAW-KNOX ELECTROFORGED STEEL GRATING

BLAW-KNOX DIVISION OF BLAW-KNOX COMPANY



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Essex Fells—Paul G. Koch

NEW YORK
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Buffalo—Reecon Company

OHIO
Cincinnati—Wyman Engineering
Cleveland—H. W. Kaiser Co.
Columbus—F. L. Purdy Co.
Toledo—George J. Haase

OKLAHOMA
Tulsa—Frick-Reid Supply Corp.

PENNSYLVANIA
Altoona—Altoona Pipe & Steel Supply Co.
Philadelphia—H. T. Potts Company

SOUTH CAROLINA
Greenville—Edward McCrady

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Bristol—J. G. Tilley
Memphis—Pidgeon-Thomas Iron Works

TEXAS
Houston—James A. Hall

UTAH
Salt Lake City—Harrison & Co.

VIRGINIA
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• It takes years to produce "thoroughbreds" and nearly a century of toolmaking skill is back of the pliers carrying the name Klein. In spite of insistent demands for increased production, Klein pliers are still individually manufactured tools—each pair of pliers a "thoroughbred" of the toolmaker's art.

Good workmen can often do a good job with inferior tools—but any workman can do a better job with Kleins. This is why Klein pliers still remain the favorite of men who take pride in the work they do—as they have "Since 1857."

Ask Your Supplier

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This book on the care and safe use of tools will be sent on request.

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Since 1857

Mathias KLEIN & Sons

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(Continued from Page 6)

opportunity to check his thinking on the subject concerned. There are, however, no answers given with the text to these problems, whereby the student may check his own work.—K.N.

INDUSTRIAL REHABILITATION, published by the American Museum of Safety and the Center for Safety Education, New York University. Copies available from the latter organization at 8 Fifth Ave., New York 11, for 35 cents each or in quantity lots at reduced price.

This publication summarizes successful methods and experience of various organizations and concerns having a wide experience in rehabilitation and re-employment of physically handicapped men, including the war disabled.

PRODUCTS

that are news

Insulating Board (800)

Durok, a 100% non-cotton cellulose electrical insulating board, has been developed by Rogers Corp., which claims for it better characteristics than 100% rag board. According to the manufacturer, the material was developed because of increasing difficulties in securing new cotton rag cuttings which have not been treated for better textile effects.

Dielectric strength ranges from 400 to 600 volts per mil; methanol and naphtha extractables are .02 to .12% and .02 to .08% respectively; tensile, elongation, tear and Mullen tests show the product to be at least 15% stronger than Duro, the company's rag board, it is stated.

Stock sheet sizes are 36 x 48 in. and 36 x 24 in., with the grain direction parallel to the second dimension. Thicknesses now available are .015, .020, .025 and .030 in. The manufacturer also fabricates the material into motor slot cells and other insulators and structural pieces.

Lightning Arresters (801)

Pellet type lighting arresters incorporating a separately sealed, nitrogen-filled gap chamber have been developed by General Electric Co. for distribution circuits 15,000 volts and below. The dry nitrogen prevents the formation of ozone or oxides, keeps the gas electrodes bright and, according to the announcement, gives more stable gap spark over characteristics. To eliminate adverse effects of internal condensation caused by outdoor temperature changes, air and atmospheric moisture are completely evacuated from the gap chamber.

Fan Motor (802)

An all-aluminum fan motor has been designed by Bogue Electric Co. for use with high-capacity blowers. It delivers 2 hp. and although designed for 24 volts d-c, can be adapted for specified voltages. The motor is self ventilated and is said to be capable of operating continually in any position in high ambient temperatures. Speeds of 5,000 r.p.m. or higher are recommended by the manufacturer.

MITCHELL INDUSTRIAL LIGHTING

gives you the advantage ...any way you look at it

Engineered for Rugged Durability

The sturdy construction of Mitchell units proves its value in long-lasting service. This means satisfied customers and repeat business.

Easy to Install and Maintain

Simplified design and easy-fit accessories provide for every method of mounting or hanging . . . make servicing quick and easy.

Top Lighting Efficiency

With Mitchell units, you assure your customers finest lighting performance. They're RLM and FLEUR-O-LIER Certified.

Gives You the Edge on Competition

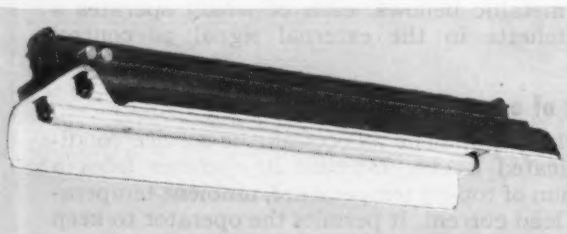
The complete Mitchell line, with outstanding performance and economy features, makes sales easier, brings you volume business.

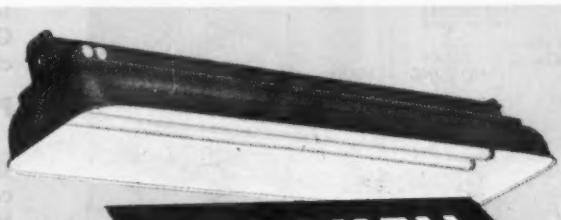
MITCHELL RLM

Mitchell industrial units give you all the lighting features *your customers* seek . . . all the selling advantages *you* want! These all-around benefits are engineered and built into every unit by MITCHELL. They enable you to render greater customer service—make easier sales—get volume business. The complete MITCHELL line of 2-40, 3-40 and 2-100 watt models provides a ready answer for every industrial lighting need.

USE THESE SALES AIDS!

Distribute full-size Catalog No. 281 and Pocket-Size Catalog No. 290. Each tells full story.





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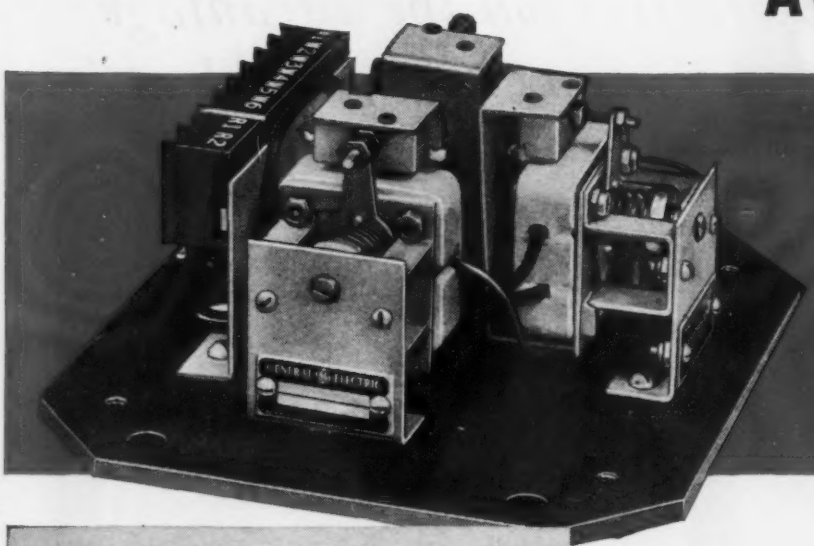
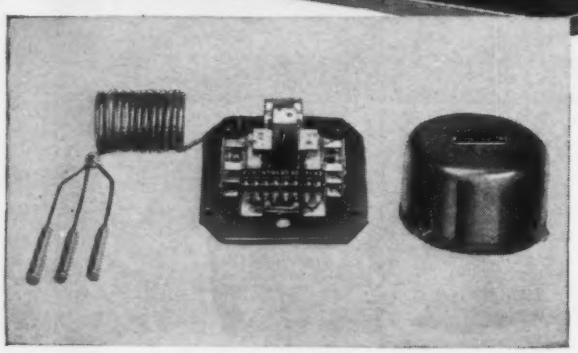
NOW Hot-spot Protection

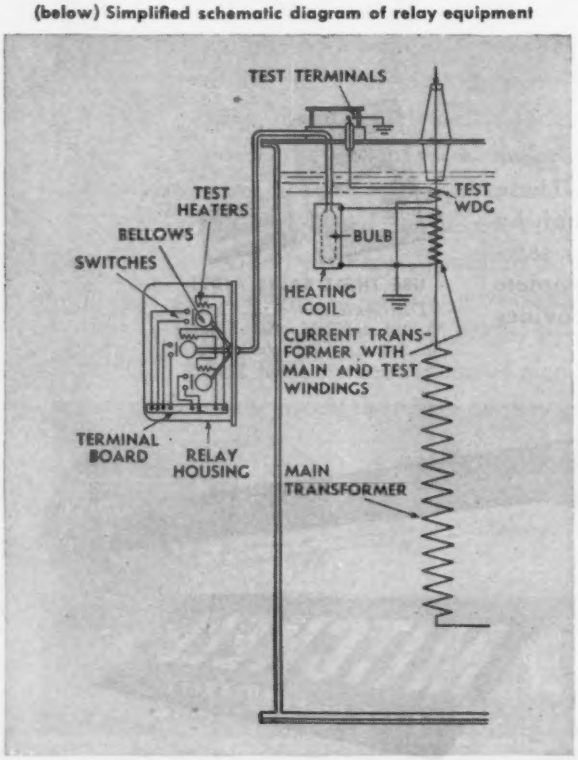
Available with G-E





Relay with cover removed, capillary tube (coiled up), and thermally sensitive bulbs—one, two, or three bulbs can be used as required.

(below) Simplified schematic diagram of relay equipment



THIS new relay equipment takes the guesswork out of power transformer loading. With it, you can be sure of getting the *maximum permissible* overload capacity whenever it is needed, in any kind of weather, under any operating conditions. Its 4-way sensitivity, being influenced by all service conditions, makes it possible to prevent damage to the transformer from overloads.

Does these three important jobs

The relay has three separate contacts, which automatically close in sequence as the winding hot-spot temperature increases. On a self-cooled transformer with cooling fans for supplementary rating, the relay does the following jobs.

1. *Starts cooling fans* as soon as the limit of the self-cooled, load-carrying capacity of the transformer is reached.
2. *Gives warning signal* as soon as an overload has been on for the permissible length of time.
3. *Sounds alarm or trips circuit breaker* when overload exceeds specified limits, taking the transformer off the circuit.

How it is constructed

This relay equipment consists essentially of one to three heating coils, supplied by current transformers, each coil containing a thermally sensitive bulb (see diagram at left) connected through a capillary tube to three metallic bellows, each of which operates a G-E Switchette in the external signal or control circuits.

Principles of operation

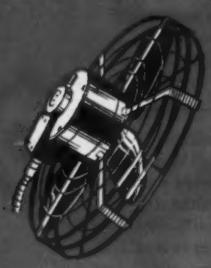
This relay equipment reflects all the service conditions indicated above. Because it operates from a combination of top-oil temperature, ambient temperature, and load current, it permits the operator to keep winding hot-spot temperatures within values recommended by industry standards. A relay which has no

...on without Sacrificing Loadability

G-E power transformers

...IN(MPERATURE RELAY HAS 4-WAY SENSITIVITY

2. Duration of overload



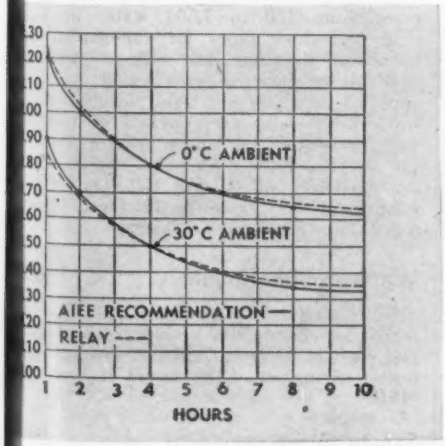
3. Method of cooling

4. Ambient temperature

ambient temperature compensation, if set for maximum permissible hot-spot temperature in average weather, can mislead the operator, as it permits excessive overloads in cold weather and prevents maximum permissible overloads in hot weather. The G-E relay operates accurately in all ambients. Overloads can be limited to values in close agreement with AIEE recommendations (see chart below) for all overload conditions. When used on a three-phase transformer, the relay can be arranged to operate in response to the temperature of the phase which has the greatest load.

This unique relay equipment can be obtained on all new G-E power transformers, as an optional item, at a slight increase in the over-all transformer price. All the parts are accurately adjusted at the factory to assure matched performance with each transformer.

For full information on how this relay works, and other descriptive data, ask for Bulletin GEA-4396. *General Electric Company, Schenectady 5, N. Y.*



Overload values as limited by the relay in relation to AIEE recommendations. The relay curves are based on operation of the final contact.

POWER TRANSFORMERS

GENERAL ELECTRIC

401-24-5155

What to use . . .

for convenience, economy, efficiency . . . in the installation of modern lighting systems, whether incandescent, fluorescent or newly developed light sources are specified.

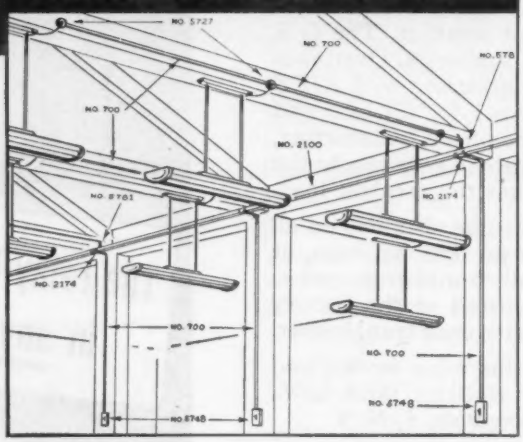
WIREMOLD
surface
METAL RACEWAYS

A complete series of basic surface raceway wiring systems . . . each with its own range of installation fittings . . . interconnectable one with another and with already installed wiring.

WHERE TO USE IT . . .

In this photograph is shown a typical use of Wiremold 2100 and 700 raceways with their installation fittings in wiring a building of mill type construction for fluorescent lighting units. Note the wide adaptability of Wiremold in handling a difficult ceiling installation and the convenient arrangement of switch controls on the building columns.

HOW TO USE IT . . .



Diagrammatic drawing shows the fittings used in this type of installation and emphasizes the interconnectability between the different sizes of raceway, which is an important feature of Wiremold. By using the various sizes of Wiremold raceways, interconnecting with each other and with existing wiring installed in the building, it is possible to plan a complete wiring layout from panelboxes to outlets with maximum economy in material and in time of installation. Write to The Wiremold Company, Hartford 10, Conn., for a copy of the Wiremold Catalog and Wiring Guide #16A and Engineering Data Sheets covering this type of installation.

THE WIREMOLD COMPANY
HARTFORD 10, CONN.

ELECTRICAL CONTRACTORS . . .

Business publications like these, with aggregate circulation of over 240,000 monthly among your prospects and customers, carry Wiremold advertising messages designed to HELP YOU BUILD BUSINESS. Tie in with this aggressive promotion program.

NEMA **KNOW YOUR WIREMOLD**
BUSINESS BUILDER IN TOMORROW'S MARKET FOR ADEQUATE WIRING

Clothes Dryer (803)

An automatic clothes dryer will be put into mass production by Westinghouse as soon as facilities and materials are available, the manufacturer has announced. This equipment is a companion piece to the company's automatic washer, being identical in shape and size and performing its cycle in approximately the same time. It contains a large perforated metal basket which, when in operation, is rotated at slow speed while a fan circulates heated air which carries away moisture from the clothes. A thermostat turns off the heaters automatically when the clothes are dry. However, where it is desired to remove clothes while still wet, the dryer can be stopped manually. In operation the machine gives a continuous tumbling or "fluffing" to the clothes.

Series Slimline (804)

Development of Slimline fluorescent lamps suitable for use on series circuits has been announced by General Electric Lamp Department. The lamp and its socket are being designed together, as in the case of the multiple lamp, with advantages of utility, safety and appearance and even nominal length. Types to be offered for series circuit operation are being studied, according to the announcement, and it is expected that both hot and cold cathode types will be made available.

Incandescent Lamps (805)

Sylvania has available incandescent lamps rated from 150 to 1,500 watts in eight sizes and three types for commercial and industrial lighting. All wattage sizes are available in clear; inside frosted types are supplied in 300 watts and larger; inside white bowl bulbs are supplied in 150, 200 and 300 watts. All lamps are supplied for use on 115-, 120- or 125-volt circuits. Standard packages of 60 for 150- or 200-watt lamps; 24 for 300-watt; 12 for 500-watt; 6 for 750-, 1,000- or 1,500-watt.

Waterproofing Liquid (806)

U. S. Industrial Chemicals Inc. has released for civilian use a waterproofing liquid for electric motors, ignition systems, batteries, wiring, etc. The liquid is known as "PiB."

Safety Glove (807)

American Optical Co. has a safety glove made from chrome-tanned cowhide, which it recommends for welding and other heavy duty operations.

FWDs...the TRUCKS with MORE "GOING POWER" for ALL Season ALL Year Line Construction and Maintenance

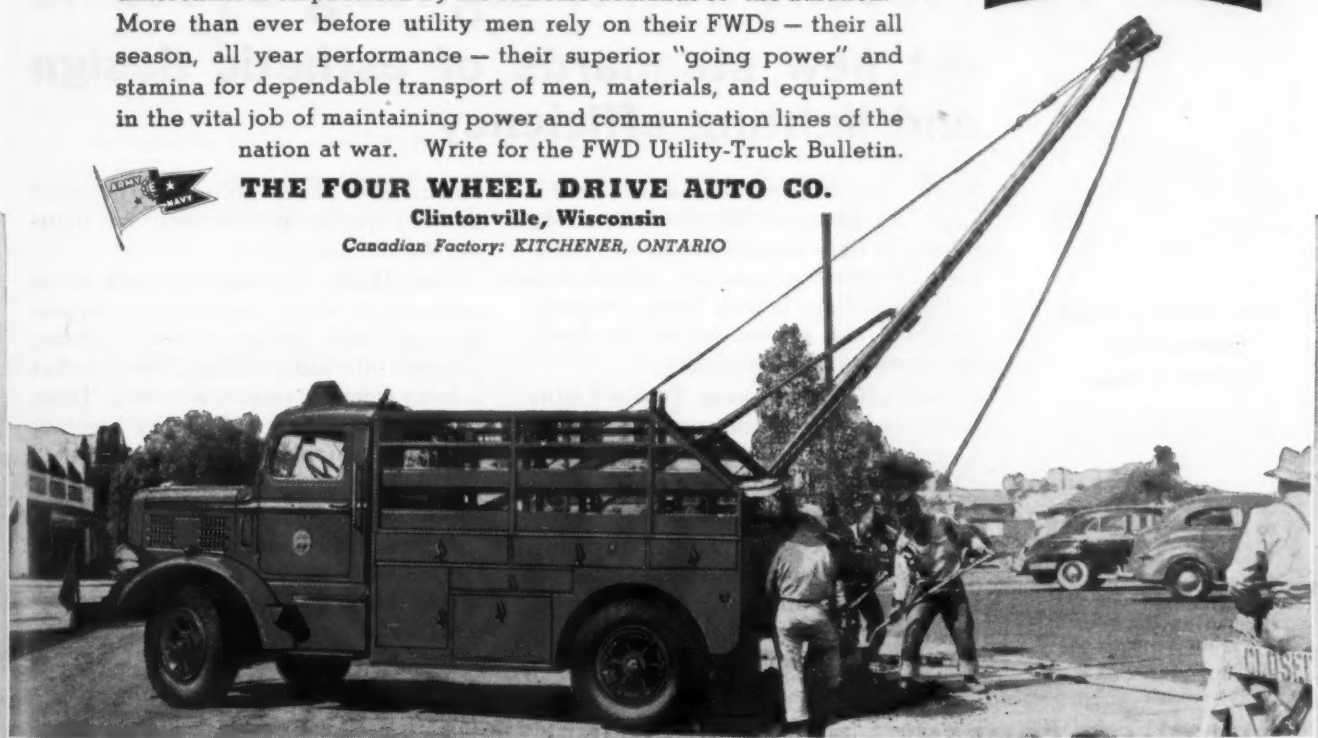
FWD TRUCKS

THE ORIGINAL EXCLUSIVE BUILDERS OF FOUR-WHEEL-DRIVE TRUCKS

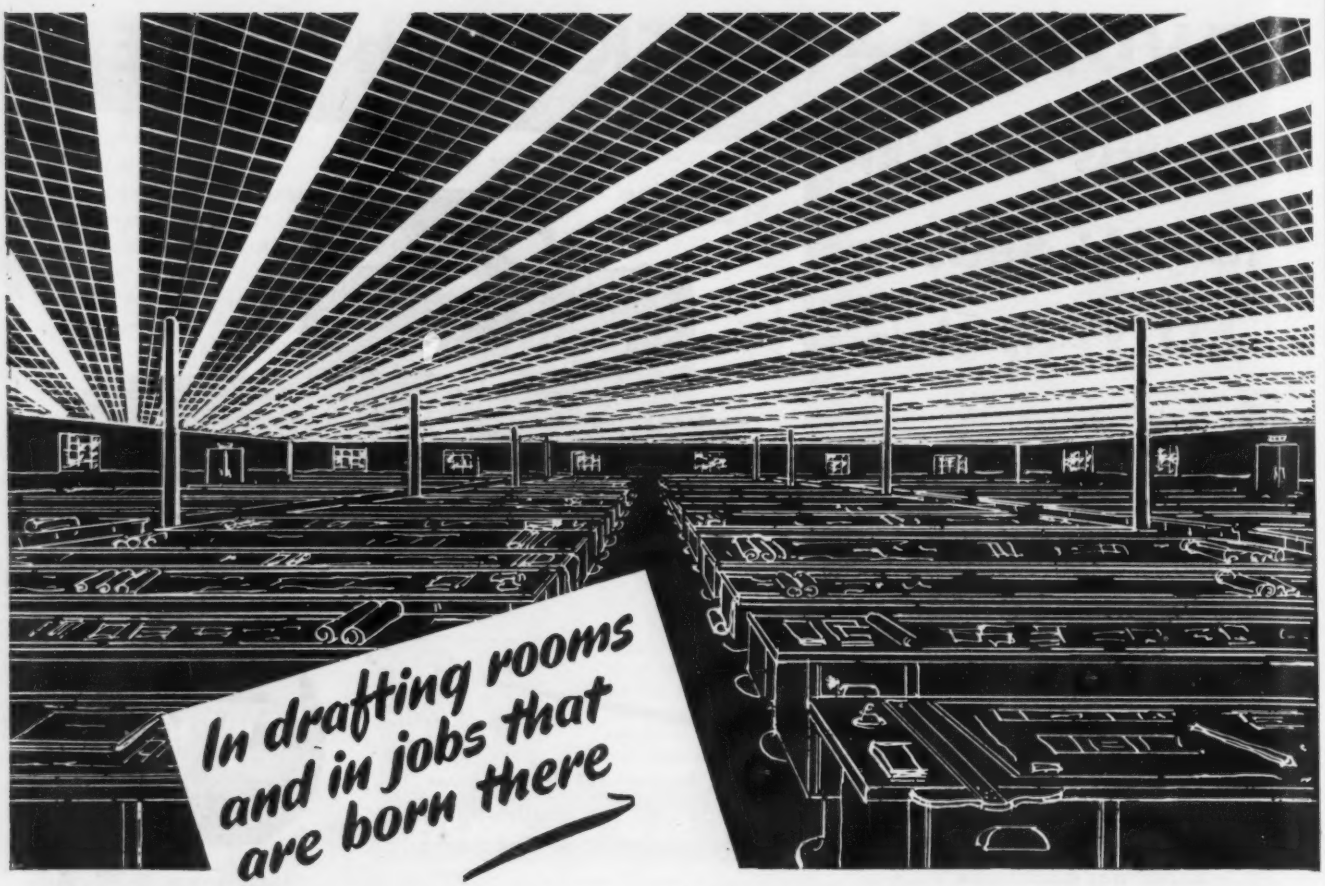
FWD Trucks are engineered and built with four-wheel-drive power, ruggedness and reliability to "take in stride" all the tougher-than-usual line construction and maintenance jobs utilities encounter under war conditions.

The value of FWD's true four-wheel-drive principle with center differential is emphasized by the extreme demands of "the duration." More than ever before utility men rely on their FWDs — their all season, all year performance — their superior "going power" and stamina for dependable transport of men, materials, and equipment in the vital job of maintaining power and communication lines of the nation at war. Write for the FWD Utility-Truck Bulletin.

THE FOUR WHEEL DRIVE AUTO CO.
Clintonville, Wisconsin
Canadian Factory: KITCHENER, ONTARIO

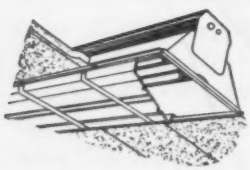


FWD Distributors: ARIZONA—Arizona-Cedar Rapids Co., 401 N. First St., Phoenix; CALIFORNIA—The Four Wheel Drive Auto Co., 1339 Santa Fe Ave., Los Angeles 21 and FWD Pacific Co., 469 Bryant St., San Francisco 7; COLORADO—Liberty Trucks & Parts Co., P. O. Box 1889, Denver 1; IDAHO—Intermountain Equipment Company, Broadway at Myrtle St., Boise; MONTANA—Steffeck Equipment Co., 11 E. Cutler St., Helena; NEVADA—Allied Equipment Co., Reno; NEW MEXICO—The Myers Company, Las Cruces; OKLAHOMA—Halliburton Oil Well Cementing Co., P. O. Drawer 471, Duncan; OREGON—Feenaughty Machinery Co., 112 S. E. Belmont St., Portland 14; UTAH—Cate Equipment Co., 49 E. 9th So., Salt Lake City; WASHINGTON—Feenaughty Machinery Co., 1028 6th Ave., So. Seattle 2, Glenn Carrington & Co., 91 Columbia St., Seattle, and Feenaughty Machinery Co., 715 N. Division St., Spokane; WYOMING—Wortham Machinery Co., 517 W. 17th St., Cheyenne; ALASKA—Glenn Carrington & Co., Nome, Fairbanks, Anchorage.



Miller Fluorescent Troffer Lighting Systems

set new standards of esthetic design and lighting efficiency



Other Pluses of MILLER Fluorescent Troffer Lighting Systems:

Supports from structural ceiling reduced 50 to 75%.

Conduit and conduit fitting costs reduced up to 80%.

Wiring costs reduced up to 50%.

Permanent operation and maintenance economies.

You'll find Miller Fluorescent Troffer Lighting Systems in many drafting rooms. In these rooms, tomorrow's housing of commerce, industry, schools and public buildings is now being designed. Designed and *worked out* by the hard-boiled rules of practicability.

For Miller Fluorescent Troffer Lighting Systems lick lighting problems, planning problems *and* structural problems. So much so, that today's trend is to plan the *building* around the *lighting!*

Miller Fluorescent Troffer Lighting Systems, in geometric patterns and lightstrips "by the mile", suggest new architectural themes. So does their versatile variety of glass and plastic lenses, plates, and metal or plastic grilles... all designed to meet specific architectural and lighting requirements.

The Miller Patented Bracket is an example of Miller engineering. Instead of laboriously fitting recessed lighting systems into hung ceilings, this bracket is hung from the *structural* ceiling. Then, both furred ceiling and Troffer Lighting System are simply hung *from the bracket!*

There are other Miller advantages that can be best explained first-hand.

Miller field engineers are conveniently located to counsel and serve you. It might be a good idea to call one—right now.

THE MILLER COMPANY • MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners and Liquid Fuel Devices

ROLLING MILL DIVISION
Phosphor Bronze and Brass in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Materiel

FOUNDRY DIVISION
Non-Ferrous Metal Castings

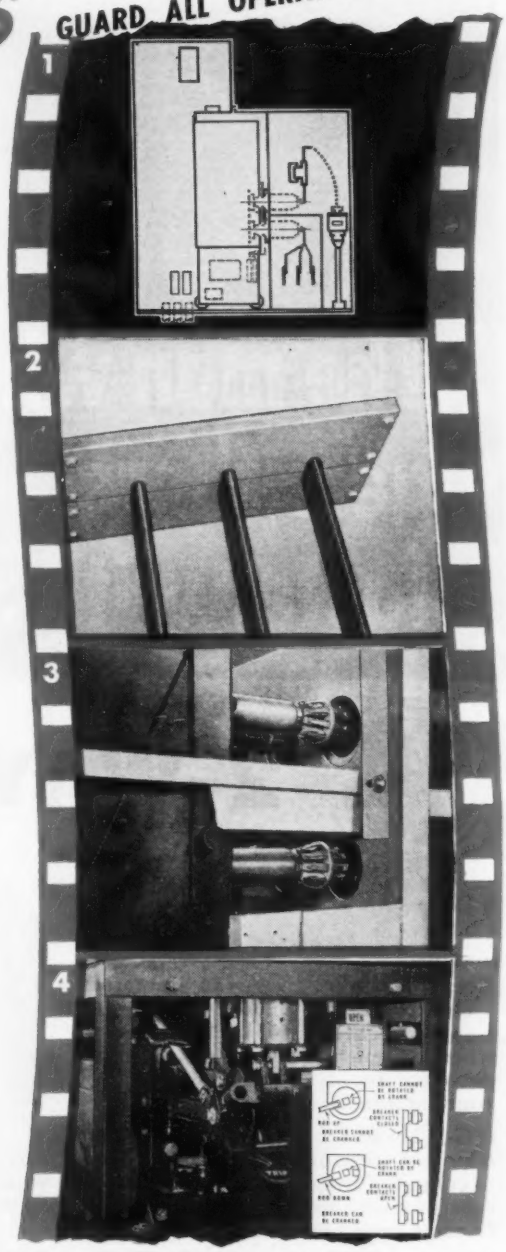
MILLER
SINCE 1844

YOU GET ALL 5 WITH "UNITIZED"

★ Quicker ordering, manufacturing, shipment
★ Improved service continuity
★ Complete operating safety
★ Easy accessibility
★ Advanced manufacturing and design features

Full steel barriers PROVIDE COMPLETE ISOLATION

Positive interlocks GUARD ALL OPERATIONS



The standardized design of "Unitized" Switchgear insures the inclusion of complete safety features which are much more likely to be overlooked or neglected in "piece-by-piece" assembly, or conventional switchgear.

In addition to metal barriers forming compartments for buses, instrument transformers, etc., as illustrated in diagram (1) at the right, close-fitting Micarta bus supports (2) prevent gas migration between compartments. Complete bus insulation provides added protection.

A 1/8-inch metal shutter (3) positively prevents accidental entry into live stationary contacts. The shutter is raised automatically as the circuit breaker is levered into the operating position. And a special cam lock prevents cranking breaker into final contact when breaker contacts are closed.

Call your Westinghouse office for complete information.

J-60589

SEND FOR THIS BULLETIN

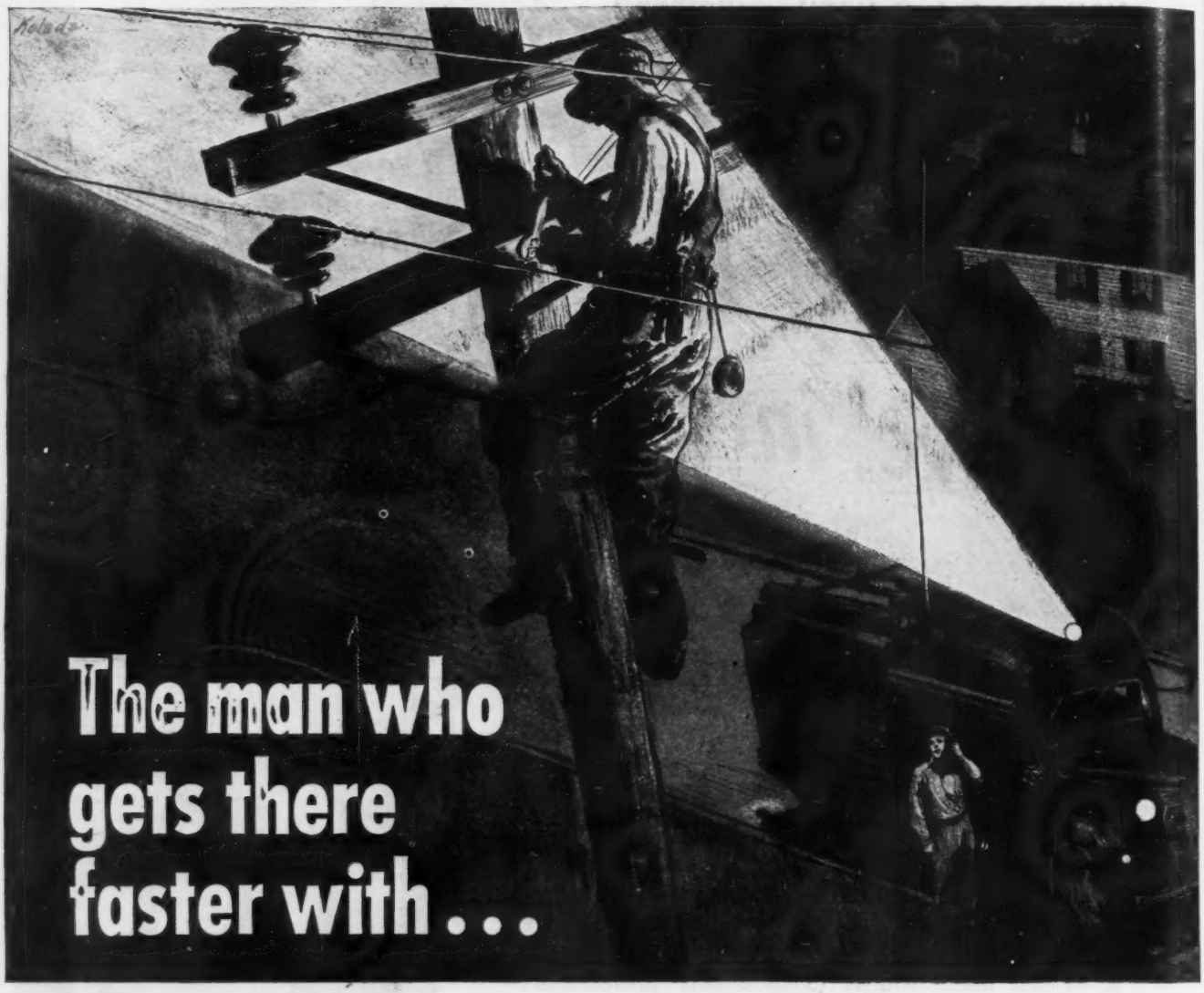
B-3036 gives complete details of "Unitized" Switchgear safety features. Write for it to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

1. Solid metal barriers insure complete safety for operators and equipment.
2. Micarta bus supports prevent gas migration between compartments.
3. Metal shutter, operated automatically, prevents accidental entry to live contacts.
4. Interlocks prevent inserting or removing breaker unless breaker is in open position.

"UNITIZED" SWITCHGEAR

WESTINGHOUSE "UNITIZED" SWITCHGEAR IS AVAILABLE WITH AIR OR OIL BREAKERS TO MEET EVERY REQUIREMENT

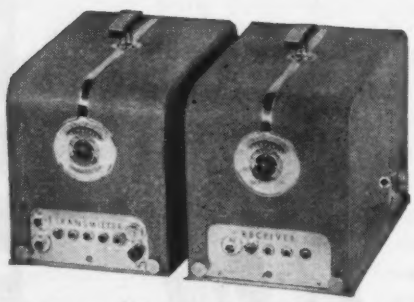


2-WAY FM RADIO

● Did you ever need maintenance in a hurry?

● With G-E 2-way FM radio your service man can be contacted instantly —at all times, anywhere within your system. Regardless of time or place, when the emergency strikes, he can get there faster. G-E 2-way radio is your assurance of that service.

● G-E 2-way FM radio is an effective maintenance tool that will enable you to communicate direct with your field repair crews and enable them in turn to communicate with each other. It is capable of giving reliable, long-range communication under the most adverse conditions, day and night. It will provide the means for immediate dispatch of maintenance crews from one job to another. It will save time when time is most valuable. It will definitely lower maintenance costs.



● Call your G-E sales engineer when you discuss your communication plans. He will assist in planning the most effective 2-way radio system for your particular installation. *Electronics Department, General Electric, Schenectady 5, New York.*

Government regulations now permit new installations of 2-way FM radio for important requirements of utility companies. Your G-E representative will help prepare your application.

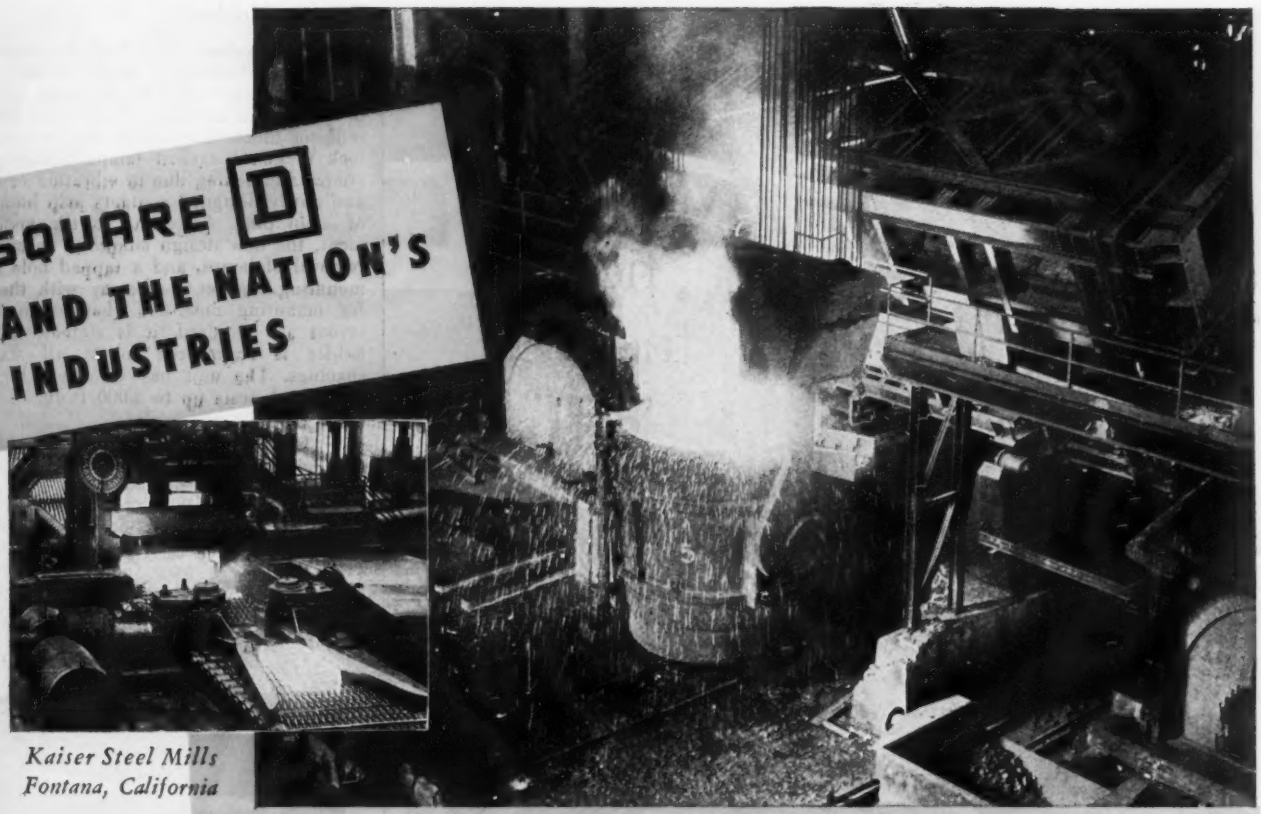
Use G-E Electronic Tubes for maximum communication dependability.

Everything for 2-way radio communication

GENERAL ELECTRIC

163-D14-6

SQUARE D
AND THE NATION'S INDUSTRIES



Kaiser Steel Mills
Fontana, California

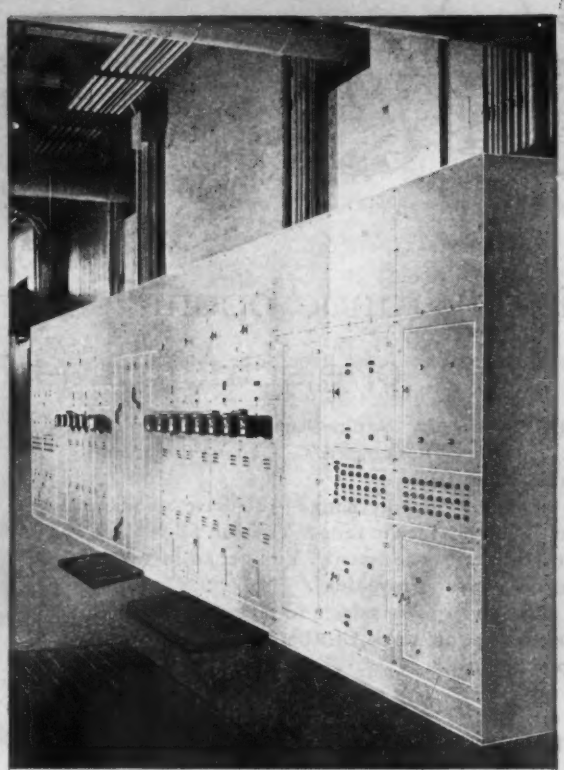
America's Vital Steel Industry looks to SQUARE D for Electrical Control...

Wars are won or lost in direct ratio to the amount of steel produced. That America's great steel industry has been able to break all records in both quantity and quality is due to many factors. One of the most important is the fact that Square D Electrical Equipment has accounted for perfect operational efficiency in avoiding costly shutdowns and keeping the ingots rolling out in a steady flow.

In all of our great steel producing centers, Square D Equipment is doing a "bang-up" job which makes it the favorite of steel and electrical engineers the nation over.

The success of Square D Electrical Control Equipment is built upon four basic principles: *Precision workmanship; correct design; sound engineering and trouble-free operation.*

The name, Square D, has become the working symbol for perfection in electrical control throughout our national industrial life.



Typical installation of Square D Switch Board in the Kaiser Steel Mills, Fontana, California.

SQUARE D COMPANY

LOS ANGELES 21 • SAN FRANCISCO 3 • SEATTLE 1 • DENVER 4 • DETROIT 11 • MILWAUKEE 2

Fit any range opening in all makes of electric ranges!

CHROMALOX *Electric* Range Replacement Units—famous *Tubulars* . . . *Superspeeds* . . . *Heatflos*—are an unbeatable profit trio.

With Snap-On Adaptor Rings—you have standard units that fit every electric range. You can fill replacement orders speedily and easily. You get an increased turnover on a smaller inventory.

This adds up to *more* sales and *bigger* profits with *less* effort when you stock CHROMALOX Range Units for Replacements.

30 years of research and engineering in electric heating are behind every CHROMALOX Range Unit. Manufacturers, dealers and range owners rely on CHROMALOX for speed, Long Life and Economy.

Edwin L. Wiegand Co.

7540 Thomas Boulevard Pittsburgh 8, Pa.

Montgomery Bros., 420 S. San Pedro St., Los Angeles, Calif.; 2333 N.W. Westover St., Portland 10, Oregon; 61 Fremont St., San Francisco 5, Calif.; 911 Western Ave., Seattle 4, Wash.
The Peterson Co., 1921 Blake St., Denver 2, Colorado

on new ranges and for replacements

CHROMALOX
"Electric Cooking at its Best!"

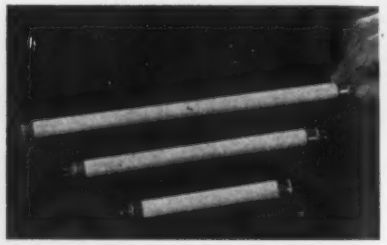
RC-7

F Lamp Holder (808)

Lloyd Products Co. has developed the "Flex-loc" fluorescent lamp holder which adjusts automatically to variations in length of lamps and spacing of mounting holes in reflector units. The holder has an automatic lock to guard against lamps falling out or contacts loosening due to vibration or shock, and newly designed contacts grip both sides of lamp pins. According to the announcement, the new design simplifies insertion or removal of lamps, and a tapped hole in the mounting bracket does away with the need for mounting nuts. No changes in fixture layout are required, it is stated, since the holder is engineered to fit all standard spacings. The unit has withstood high impact shock tests up to 2,000 ft.-lb.

Miniature F Lamps (809)

Sylvania has announced miniature fluorescent lamps in 6-, 9- and 12-in. lengths, rated at 4, 6 and 8 watts respectively, for 110-125-volt a-c operation on instrument lighting, displays, small portable lamps, domestic night lights, etc. These lamps are equipped with standard miniature bipin bases for mounting in miniature lamp holders. Approximate initial lumen output from white lamps ranges from 73 in the 4-watt size to 580 in the 13-watt size. Daylight lamps of the same sizes produce 68 and 490 lumens. Rated average life, based on specific three-hour cycle test conditions, is 1,500 hours for all except the 4-watt lamp, which has a 500-hour rating. Standard packages contain 24 lamps.



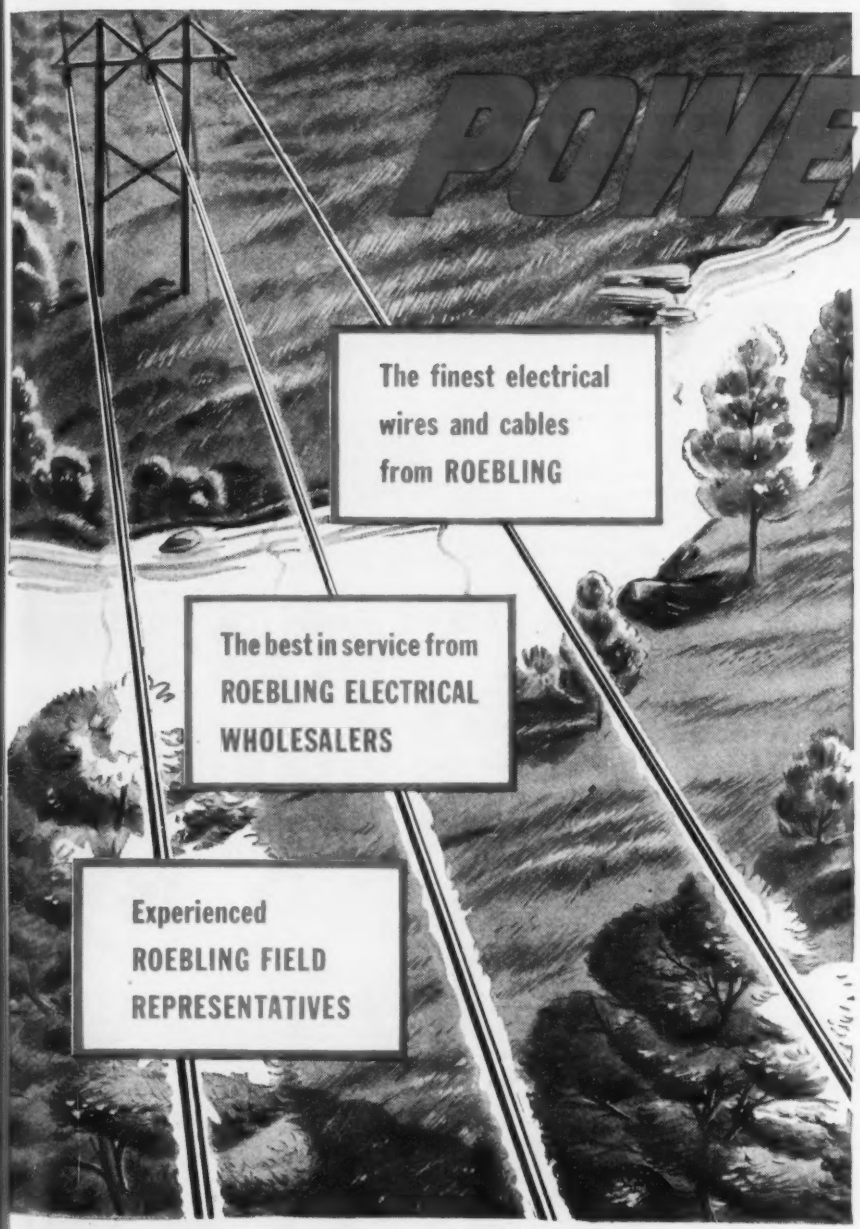
Ballasts for Circline (810)

Disk-shaped ballasts for operation of 12-in. Circline fluorescent lamps have been announced by General Electric. These flat disks have a center hole for mounting, making them readily adaptable to assembly in a portable lamp base and in shallow type wall or ceiling fixtures. They are available now in two single-lamp types: A conventional, uncorrected power factor design and a high power factor, lead circuit design without a step-up autotransformer. A compensator is provided in the latter to raise the starting current and it is intended for use only with a manually operated starter. Leads of both types are brought out through the ballast cover plate and threaded through the lamp stem for connection.

Seam Welder (811)

Progressive Welder Co. is offering a Duplex seam welder designed for simultaneous welding of two or more parallel seams on one surface. Available with transformer capacities up to 500 kva. and in a range of work table sizes and travels, these machines are air operated and fully automatic. A duplex head on the machine accommodates two or four welding wheels.

ROEBLING


POWER
The finest electrical wires and cables from ROEBLING
The best in service from ROEBLING ELECTRICAL WHOLESALERS
Experienced ROEBLING FIELD REPRESENTATIVES

TO HELP YOU DO A BETTER JOB

WHEN TOMORROW'S COMPETITION SETS IN

HERE'S YOUR THREE LINE SYSTEM to give you extra power when the going gets tough. With tomorrow's competition—you'll need more than quality equipment alone. You'll need the best in service, too. And you'll get it from Roebling Electrical Wholesalers . . . Roebling Field Representatives: *when you need it . . . where you need it . . . and at the right price.*

We're doing our part today to see that you get Roebling wire and cable that embodies every modern development—made of the finest materials available.

To meet tomorrow's competition—look to Roebling quality products and service... Roebling Electrical Wholesalers. *They're teamed for your future profits.*

JOHN A. ROEBLING'S SONS COMPANY OF CALIFORNIA
San Francisco • Los Angeles • Seattle • Portland

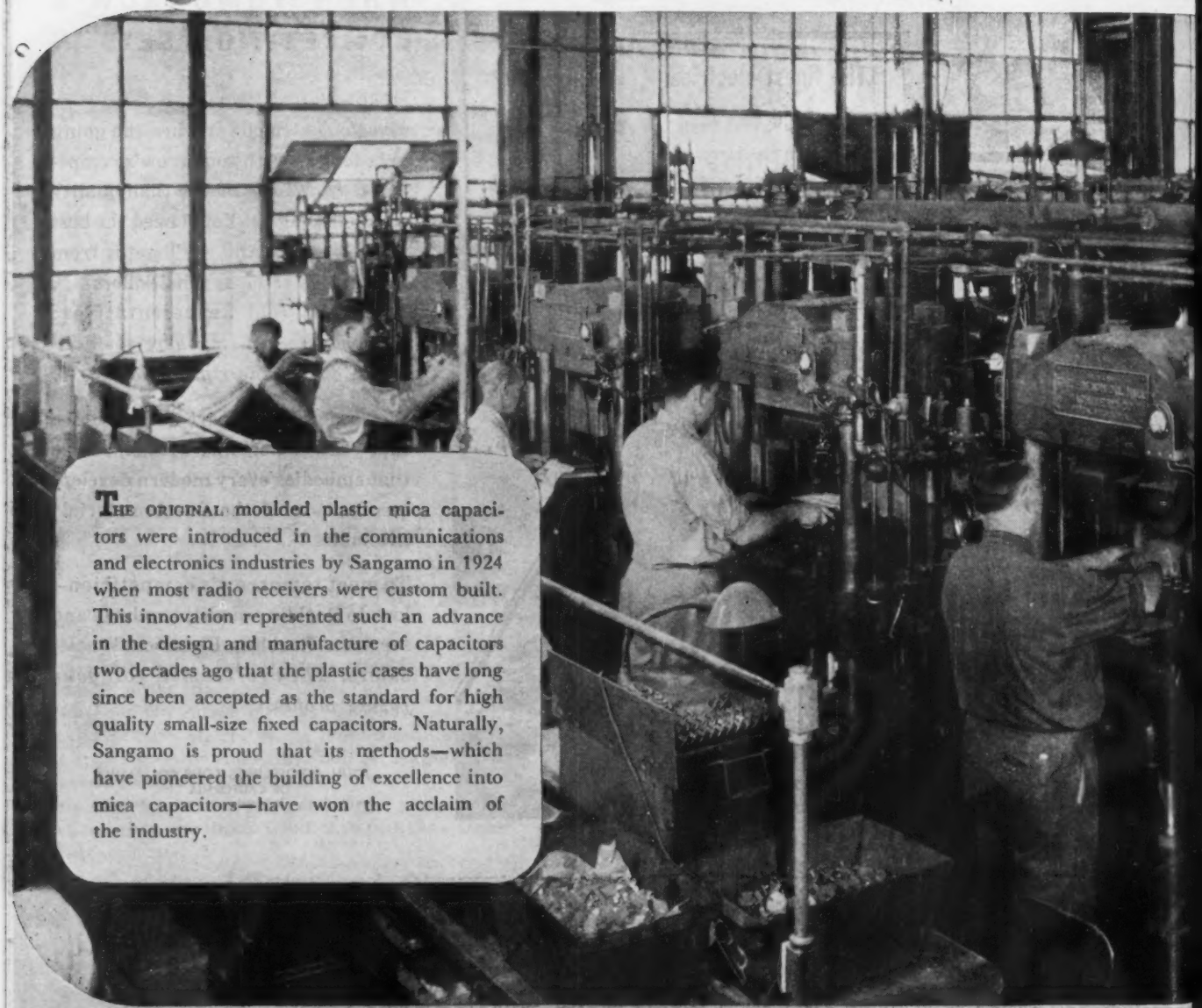
ROEBLING ELECTRICAL WIRES AND CABLES

WEATHERPROOF WIRE • SERVICE ENTRANCE CABLES • RUBBER COVERED WIRES AND CABLES (INCLUDING THIN-WALL INSULATED BUILDING WIRES AND CABLES) • RUBBER INSULATED POWER CABLES • PIGTAIL AND BRAIDED COPPER • TELEPHONE WIRES • RUBBER SHEATHED PORTABLE CABLES • BARE COPPER STRAND • MAGNET WIRE • VARNISHED CAMBRIC POWER CABLES • TROLLEY CONTACT WIRE

PACEMAKER IN WIRE PRODUCTS

HOW EXCELLENCE IS BUILT INTO

Sangamo MICA CAPACITORS



THE ORIGINAL moulded plastic mica capacitors were introduced in the communications and electronics industries by Sangamo in 1924 when most radio receivers were custom built. This innovation represented such an advance in the design and manufacture of capacitors two decades ago that the plastic cases have long since been accepted as the standard for high quality small-size fixed capacitors. Naturally, Sangamo is proud that its methods—which have pioneered the building of excellence into mica capacitors—have won the acclaim of the industry.

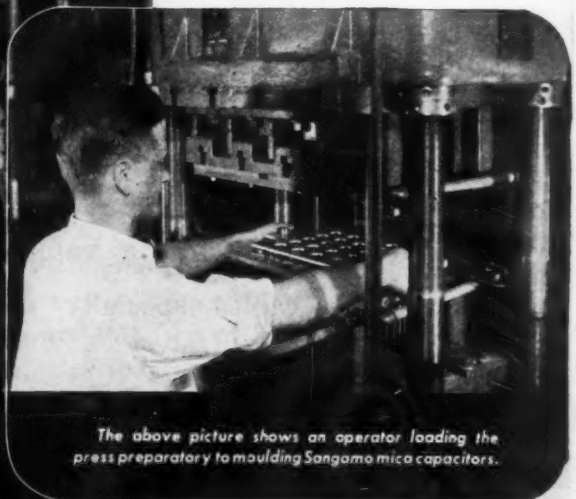
Moulding presses used in the production of Sangamo capacitors.

SANGAMO ELECTRIC

ESTABLISHED 1898 • • • MICA CAPACITORS • • •

Capacitor MOULDING

IN ORDER to insure the continued satisfactory operation of a mica capacitor, it is essential that the capacitor element be provided with a shell or housing of some sort. This housing not only serves to give the capacitor increased mechanical strength and, consequently, durability, but also serves to help prevent the absorption of moisture and to retain the desired characteristics built into the capacitor unit. Prior to about 1924, most mica capacitors were mechanically held by using two outside plates of fiber or other insulating material, which were riveted together to form a housing or protective case for the unit. This did not prevent the absorption of moisture. In 1924, Sangamo conceived the idea of moulding mica capacitor elements in plastic or bakelite cases, and this proved so satisfactory that this method of housing capacitors has been employed ever since. Mica capacitors are moulded in presses, where the proper operating temperatures and pressures insure uniform, thoroughly cured plastic enclosures. Highly polished dies result in a capacitor with a smooth, glossy finish which is moisture resistant. Various moulding compounds can be used in the production of mica capacitors, but those most commonly used are of the low loss mica filled types, which contribute to high insulation resistance and high "Q" values in the finished capacitor. The use of plastic housings contributes greatly to the excellence of the quality in Sangamo mica capacitors.

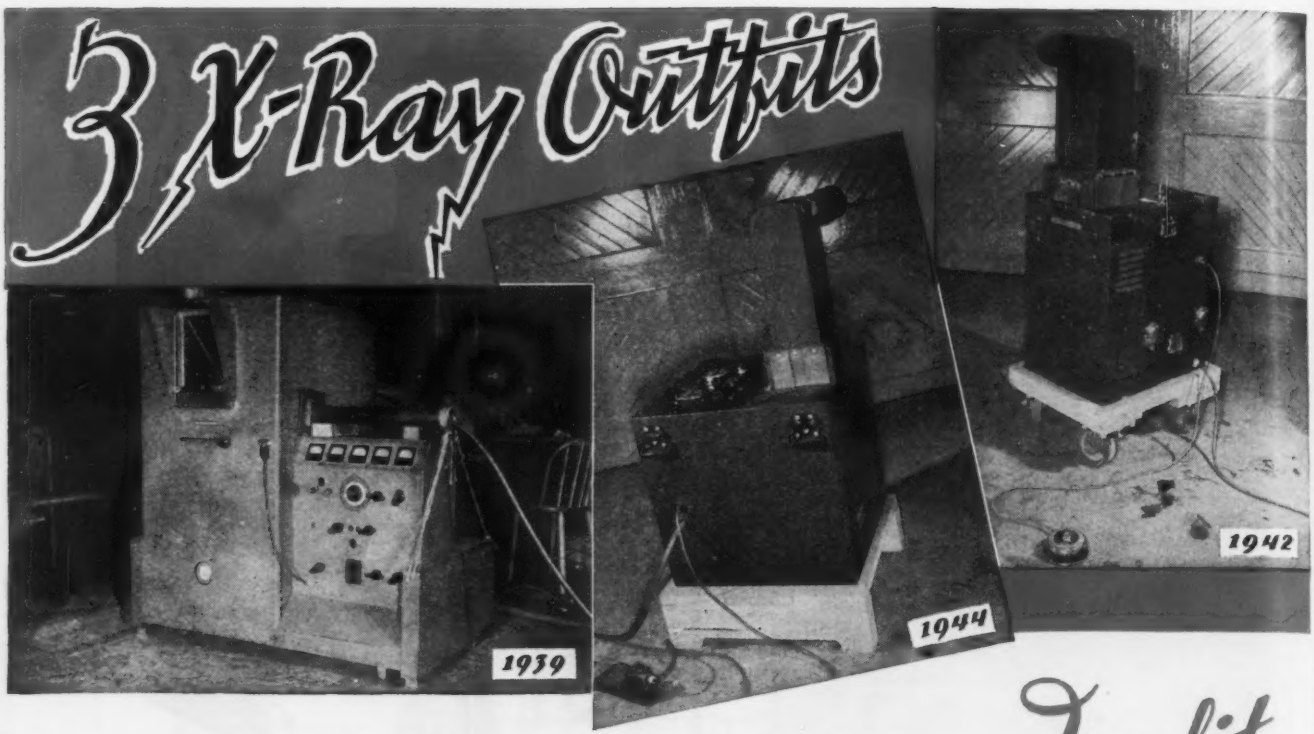


The above picture shows an operator loading the press preparatory to moulding Sangamo mica capacitors.

ARMY E NAVY

COMPANY SPRINGFIELD ILLINOIS

• • • WATT HOUR METERS • • • TIME SWITCHES • • •



NOW HELP TO MAINTAIN SIMPLEX *Quality*

Three X-ray outfits at Simplex are used for routine tests and inspection of insulation and cable cores to make sure that Simplex quality is maintained. They also enable us to investigate hidden, internal causes of electrical weaknesses such as air pockets and foreign particles in insulations. They are a valuable aid in developing cables specially designed to meet unusual service requirements.

Simplex was among the first to use X-ray inspections as an aid in the design of electric cables and as a check on manufacturing processes. The first installation in 1939 was so successful that a second outfit was added in 1942 and a third in 1944. All three are now helping to maintain Simplex quality.

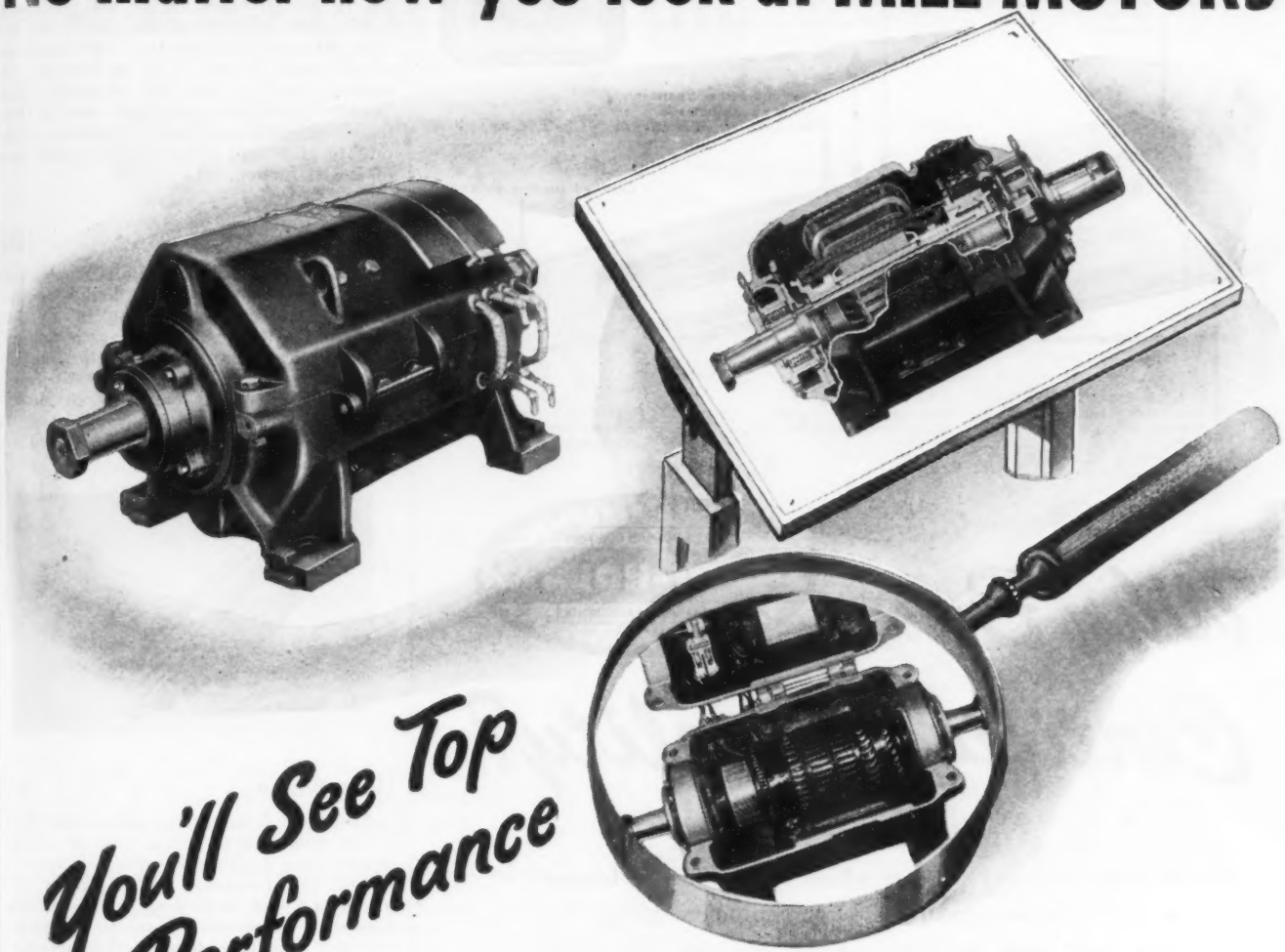
Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

ARMY E NAVY

Simplex

WIRES and CABLES

No matter how you look at MILL MOTORS



You'll See Top Performance with AX5's or SA35's

GO INTO any steel mill today. You'll see excellent mill motors like these . . . giving unprecedented round-the-clock service!

In more and more of such heavy-duty motors, "National" Grade AX5 or Grade SA35 brushes are being installed. Operating men have learned that both of these electro-graphitic brush grades are *strong mechanically* . . . have superior commutating characteristics . . . combine high contact drop with low coefficient of friction . . . and are non-abrasive!

Both grades were developed after thorough studies of load and atmospheric conditions, commutator maintenance problems and many other practical, steel-mill operating factors.

They are but two of a number of carbon, graphite, electro-graphitic and metal-graphite brush grades that National Carbon Company, Inc., has developed to meet the varying needs of every class of rotating electrical equipment . . . from fractional horsepower motors to the largest motors and generators.

The word "National" is a registered trade-mark of National Carbon Company, Inc.

NATIONAL CARBON COMPANY, INC.

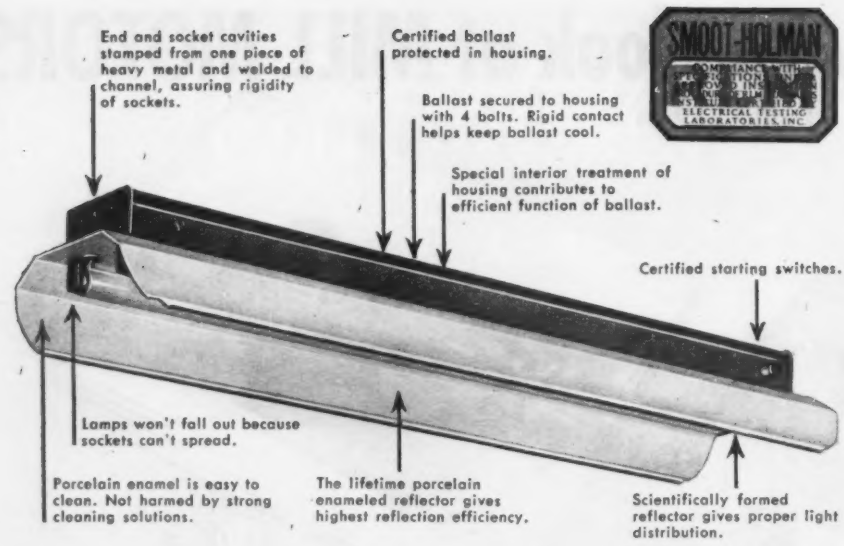
Unit of Union Carbide and Carbon Corporation

UCC

General Offices: 30 East 42nd Street, New York 17, N. Y.

Division Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

KEEP YOUR EYE ON THE INFANTRY . . . THE DOUGHBOY DOES IT!


End and socket cavities stamped from one piece of heavy metal and welded to channel, assuring rigidity of sockets.
Certified ballast protected in housing.
Ballast secured to housing with 4 bolts. Rigid contact helps keep ballast cool.
Special interior treatment of housing contributes to efficient function of ballast.
Certified starting switches.
Lamps won't fall out because sockets can't spread.
Porcelain enamel is easy to clean. Not harmed by strong cleaning solutions.
The lifetime porcelain enameled reflector gives highest reflection efficiency.
Scientifically formed reflector gives proper light distribution.
SMOOT-HOLMAN
ELECTRICAL TESTING LABORATORIES, INC.

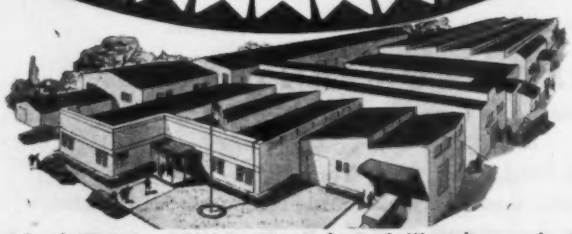
SMOOT-HOLMAN COMPANY
SMOOT-HOLMAN
INGLEWOOD, CALIFORNIA
MADE IN U.S.A.

Why Buy Certified Quality?

Because the many features which enable Smoot-Holman to certify highest quality provide equipment giving the most light with the least maintenance cost. The RLM label is an additional guarantee, because RLM quality is policed by independent testing laboratories. Rated orders for Smoot-Holman certified equipment are now being filled—general distribution must await V-J day.

BUY U.S. WAR BONDS AND HOLD THEM

SMOOT-HOLMAN COMPANY
SMOOT-HOLMAN
INGLEWOOD, CALIFORNIA
MADE IN U.S.A.



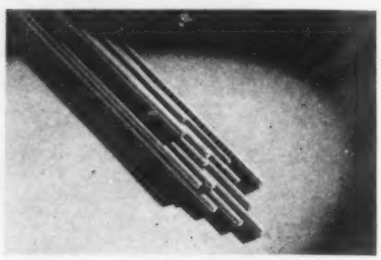
Offices in Principal Western Cities—Branch and Warehouse in San Francisco

Electronic Tubes (812)

Lock-in electronic tubes for rough service in aircraft, automotive and industrial applications have been announced by Sylvania Electric Products Inc. Tube bases are of all metal design. Solid socket pins are welded direct to the tube elements. Glass "header" construction permits use of heavier element supports, direct bonding of the pins to glass and more durable glass envelope construction, it is stated.

Electrode (813)

Westinghouse has a new ACP electrode which is available in seven diameters from 5/16 to 3/32 in. for welding in all positions and with a-c or d-c reverse polarity. It is recommended by the manufacturer for work which is not easily positioned and is said to give excellent results in making horizontal fillet welds and lap joints on low and medium carbon steels, as well as low alloy and cast steels.



Limits Bridge (814)

Associated Research has announced Model 81 low-range limits bridge, one of a series designed for high-speed sorting of resistors. It will test resistance values up to 2,000 pieces per hour, according to the manufacturer, and has an external reference standard. The unit is battery operated. Over-all adjustable range is from ¼ ohm to 10,000 ohms, with adjustable ratio arm, sensitivity control, production type test fixture with automatic on-off switch. Sensitivity control range is from ± ¼% to ± 10%. The indicator is a sensitive zero center galvanometer. Self-contained, the unit measures 8 x 8 x 12 in., weighs 18 lb.

Autotransformers (815)

Langevin Co. is offering three new continuous-duty autotransformers: Type 800-A, primary 220 volts, 60 cycles; secondary 110 volts, 250 watts; Type 801-A, primary 220 volts, 60 cycles; secondary 110 volts, 500 watts; Type 802-A, primary 220 volts 60 cycles; secondary 110 volts, 1,000 watts.

G-E Irons are on the way

Available Now—Two Fully Automatic "Dial-The-Fabric" Irons
Coming Soon—A Fully Automatic Steam Iron and a Travel Iron

You'll want to stock all four of the Irons in the General Electric line!

You know how a full line can help you get those *extra* sales! It gives your customers a *selection* of models for every ironing need . . . at a range of prices for every pocketbook!

And it gives *you* a swell chance to *sell up* to better qualities . . . building bigger dollar volume!

Your customers will want G-E!

A recent national survey asked: "If Irons were available now, which brand would you buy?"

General Electric was first choice by more than 2 to 1 over the next most popular brand!

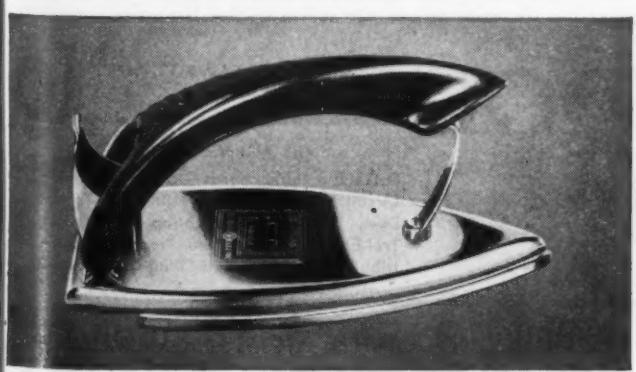
That's proof of popularity that will give G-E Irons, and *G-E Dealers*, a big head start in the postwar market.

Build your plans around the complete line of these famous irons. General Electric Co., Appliance and Merchandise Department, Bridgeport, Conn.

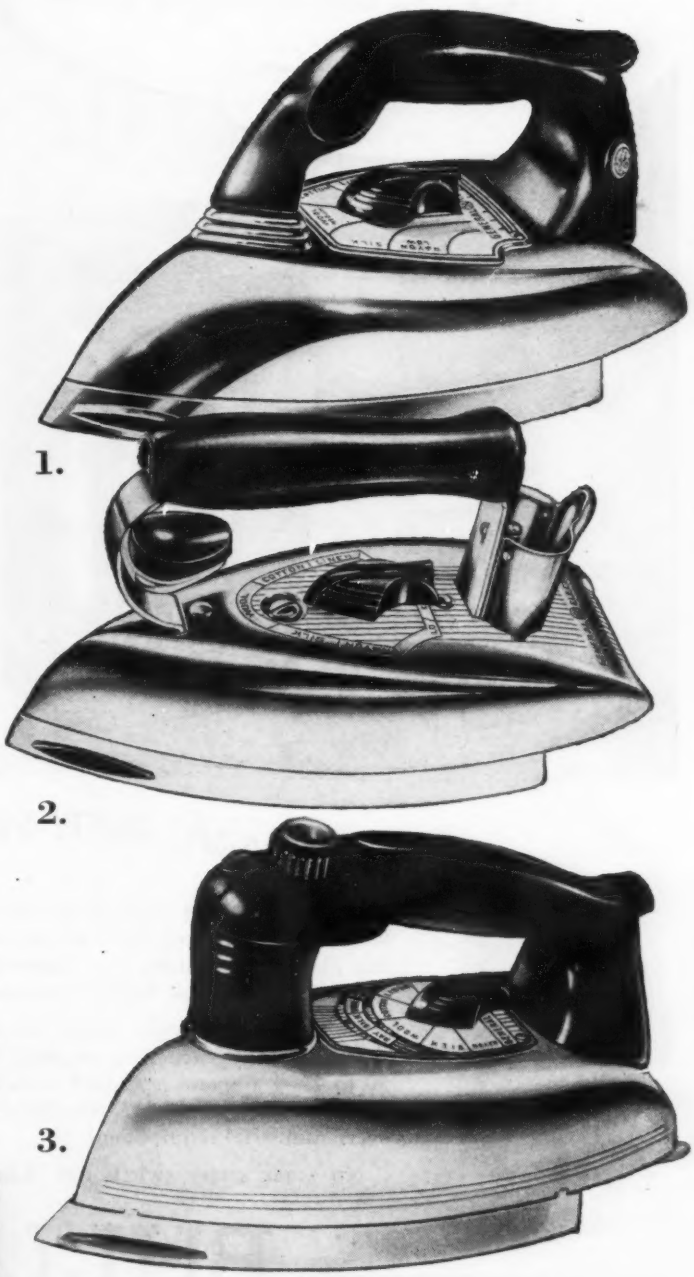
Only G-E Fully Automatic, "Dial-The-Fabric" Irons Have All These Features!

- **Famous Calrod Heating Unit**
- **G-E "Dial-The-Fabric" Heat Selector**
- **Fully Automatic—constant heat maintained**
- **Button Nooks—for ironing under buttons**
- **Thumb Rest—to relieve muscle strain**
- **Lightweight Design—cuts ironing fatigue**

1. **Fully Automatic Streamlined Iron . . . $8.33.** Available now in limited quantities. Has all the G-E features for fast, easy ironing.
2. **Fully Automatic Iron . . . $5.70.** Biggest iron value in its price class. All G-E features. Available now in limited quantities.
3. **Fully Automatic Steam Iron . . . $16.20.** All the G-E features, plus steam ironing! Can be switched from steam to dry ironing at any time.



Lightweight Folding Travel Iron . . . $5.70. Weighs only two pounds, handle folds against sole plate top for easy packing. Has heat indicator.



1.

2.

3.

FOR GOOD LISTENING: Don't miss Art Linkletter, in "The G-E House Party," every afternoon, Monday through Friday, 4 p. m., E. W. T., CBS. "The G-E All-Girl Orchestra," Sunday, 10 p. m., E. W. T., NBC. "The World Today," News, Monday through Friday, 6:45 p. m., E. W. T., CBS.

FOR FINAL VICTORY—BUY AND HOLD MORE WAR BONDS

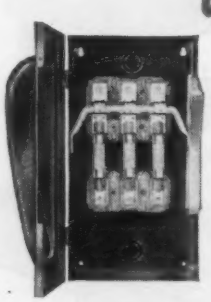
THE APPLIANCES MOST WOMEN WANT MOST

GENERAL ELECTRIC

Legionnaires

Vacu-Break SAFETY SWITCH with "CLAMPMATIC" CONTACTS

Sizes for Every Switch Job



For greater safety and dependability, longer life and lower upkeep costs, leading plants the country over depend on BullDog Vacu-Break Safety Switches.

Designed in a wide variety of sizes and types with capacities ranging from 30 to 1200 amperes, standard models of this famous switch are available for every industrial requirement.

No other safety switch has "Clampmatic" contacts, tight as a bolted connection in the ON position, to reduce heating—the Vacu-Break principle of arc suffocation to snuff out destructive arcs as quickly as they form—new simplified operating mechanism in modern streamlined cabinet.

Talk to expert BullDog field engineers about the electrical distribution problems in your plant. Or write us for literature.

BUY WAR BONDS

SALVAGE PAPER

BULLDOG

ELECTRIC PRODUCTS COMPANY

BOX 177, R. PK. ANNEX, DETROIT 32, MICHIGAN. BullDog Electric Products of Canada, Ltd., Toronto. Field Offices in All Principal Cities.

Also Manufacturers of

SafToFuse Panelboards—Switchboards—Circuit Master Breakers—Universal Trol-E-Duct, for flexible lighting—Industrial Trol-E-Duct, for movable "loads"—BUS-tribution DUCT, for "Plug-In" Power.

BULLDOG PRODUCTS ARE SOLD AND DISTRIBUTED BY THE FOLLOWING PACIFIC COAST REPRESENTATIVES:

Coast Electric & Manufacturing Co.
1720 N.E. Sixth Avenue
Portland, Oregon, Tel. Garfield 2844

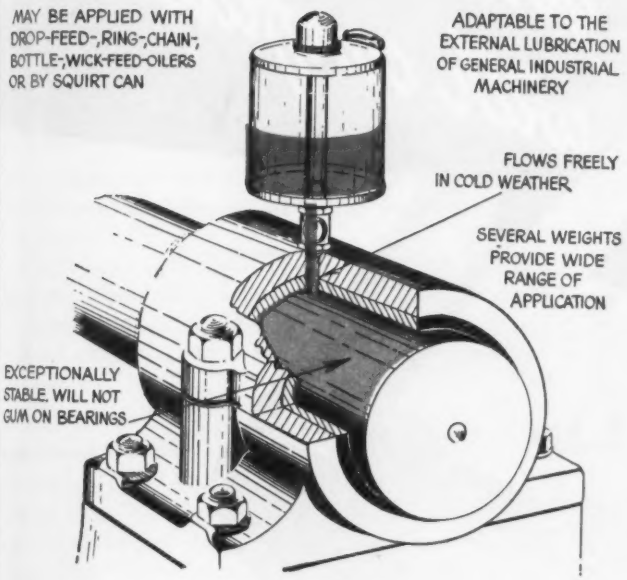
Safety Switchboard & Manufacturing Co.
1445 Stevenson St.
San Francisco, Calif., Tel. Hemlock 2470

Mullenbach Electrical Manufacturing Co.
2300 East 27th Street
Los Angeles, Calif., Tel. Jefferson 2224

STANDARD ENGINEERS NOTEBOOK

VOL. 2-W No. 8

Stable, all-purpose oils stop wear on external bearings


MAY BE APPLIED WITH DROP-FEED-, RING-, CHAIN-, BOTTLE-, WICK-FEED-OILERS OR BY SQUIRT CAN
ADAPTABLE TO THE EXTERNAL LUBRICATION OF GENERAL INDUSTRIAL MACHINERY
FLOWS FREELY IN COLD WEATHER
SEVERAL WEIGHTS PROVIDE WIDE RANGE OF APPLICATION
EXCEPTIONALLY STABLE. WILL NOT GUM ON BEARINGS

Because they are carefully refined for stability, Calol Red Engine Oils are always the same and may be depended upon to give constant, uniform protection to external bearings on all general industrial machinery. With a comparatively low carbon residue and low pour test, they have a wide range of application in all atmospheric temperatures.

They are made in five viscosity grades:

Calol Red Engine Oil—11. An all-purpose grade which can be filtered for re-use. It is used on engine bearings, machinery and shafting.

Calol Red Engine Oil—15. Heavier than Number 11 and used for the same general purposes.

Calol Red Engine Oil—18. Used on slow-speed bearings, air cylinders of blowing engines.

Calol Red Engine Oil—20. A heavy grade for heavy-duty machinery bearings.

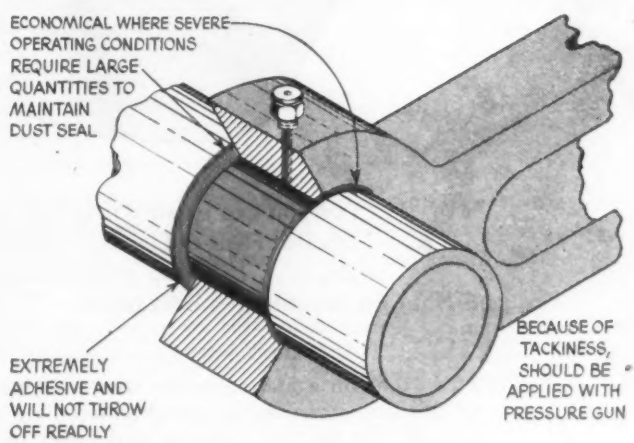
Calol Red Engine Oil—25. The heaviest grade, used for the same purposes as Number 20.

Tacky greases seal out dust and water

Where rough, grease-lubricated bearings must operate in severe conditions, Calol Multi-Service Greases are recommended. Black in color, these special base greases are blended into a heavy, rugged oil. The lubricant film they provide stands up under the heaviest shock loads. Because they are extremely adhesive, Calol Multi-Service Greases resist high centrifugal action. They are economical and maintain a seal against water and dirt.

There are seven grades of Calol Multi-Service Grease: Numbers 0 and 1, the softest, are non-fluid at ordinary temperatures. Number 0 is particularly adapted for use in cold weather. Numbers 2 and 3 are slightly heavier in consistency and higher in melting point. Numbers 4, 5 and 6 are very stiff.

In the proper grades, Calol Multi-Service Greases are used on small enclosed gears, on ball and roller mine car wheels, heavy-duty chassis, rough machinery bearings and low-speed journal bearings.


ECONOMICAL WHERE SEVERE OPERATING CONDITIONS REQUIRE LARGE QUANTITIES TO MAINTAIN DUST SEAL
EXTREMELY ADHESIVE AND WILL NOT THROW OFF READILY
BECAUSE OF TACKINESS, SHOULD BE APPLIED WITH PRESSURE GUN

HIGHLY RESISTANT TO MOISTURE

MAINTAINS RICH OIL FILM THAT RESISTS DISPLACEMENT BY SHOCK LOADS

Standard Fuel and Lubricant Engineers are always at your service. They'll gladly give you expert help — make your maintenance job easier. Call your Standard Representative or write Standard of California, 225 Bush St., San Francisco 20, California.

STANDARD OF CALIFORNIA

Certified Ballasts and Starters are an important part of Fleur-O-Lier Certification.

For you can be sure that fixtures labelled Fleur-O-Lier are RIGHT! Right . . . for top performance. And right for trouble-free operation.

Here's why:

1. This label on a fixture means that it is built to definite *authoritative specifications* . . . to provide the best in lighting and lamp performance, together with dependable service.
2. It signifies that fixtures are subject to rigid test by Electrical Testing Laboratories, Inc., and are certified by them as meeting Fleur-O-Lier specifications.
3. It brings you the knowledge and research of many of the finest technicians in fluorescent lighting.

And in addition—this label lets you choose from a wide variety of fluorescent fixtures designed to appeal to the taste and style needs of your customers—and be sure about quality!

★ ★ ★

Remember over 30 leading fixture makers build Fleur-O-Liers; so when you're planning for tomorrow's fluorescent lighting, be sure fixtures marked Certified Fleur-O-Lier are part of your plans.

FLEUR·O·LIER *Manufacturers*

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER require

FEATURES NO OTHER RANGE OFFERS

—COMING, IN THE NEW G-E RANGE!

General Electric Ranges are now in production under WPB authorization!

What ranges these new G-E's are going to be! Shining. Streamlined. Economical. All with selling points that can't miss!

You'll have G-E "Speed Cooking" to talk about. Plus marvelous G-E "exclusives" that'll make women's eyes shine!

Read all about them. Powerful, persuasive features like . . .

Improved Calrod Units!

That's how G-E "Speed Cooking" is possible—with Calrod units, the *fastest electric unit made!* Five cooking speeds—even, controlled temperatures. Easy to keep clean. (When gummy food's spilled on Calrod, it *cleans itself!*)

And talk about a service record! Out of the millions of Calrod units in service since 1932, less than ½ of 1% have been returned for service or replacement.

Tripl-Oven!

Exclusively G-E, and do the ladies love it! A Master Oven, 20% larger than most, includes a Super Broiler with radiant, charcoal-type broiling, and a smaller Speed Oven that heats to 400 degrees in 5½ minutes (faster than any other range oven)!

No-Stain Oven Vent!

G. E.'s is different from any other. Cleverly placed so that it helps keep your kitchen spotless. The result: Walls and curtains stay grease-free . . . kitchen scrub-up time is cut way down!

Tel-a-cook Lights

Another swell G-E exclusive! A distinctive color flashes on the control panel for each cooking speed . . . tells at a glance what's going on the range, where and at what speed!

• **G-E Stratoliner**—the last word in a modern electric range—available soon. Also in the line will be the G-E Airliner and G-E Leader, styled for beauty and top performance!

• • •

We're telling women all about G-E Ranges, with radio and magazine advertising. And there's already a huge market "sold" on G. E.! In fact . . .

A recent survey showed that among both men and women who intend to buy an electric range, G. E. received 56% of the votes, more than all other electric range makes combined!

G. E. has been "on the nose" with competition in each price class—and yet, because of carefully selected features to help step up the sale, *General Electric produced the highest average unit range sale in the industry!*

Before the war, G-E retailers consistently produced *more dollars* per sale on ranges . . . and that will continue!

FOR GOOD LISTENING: *Don't miss Art Linkletter, in "The G-E House Party," every afternoon, Monday through Friday, 4 p. m., E. W. T., CBS. "The G-E All-Girl Orchestra," Sunday, 10 p. m., E. W. T., NBC. "The World Today," News, Monday through Friday, 6:45 p. m., E. W. T., CBS.*

FOR FINAL VICTORY—BUY AND HOLD MORE WAR BONDS

AUTOMATIC ELECTRIC **RANGES** | "THE APPLIANCES MOST WANTED BY MOST WOMEN"

GENERAL ELECTRIC

Eliminate THE HAZARDS OF EXPOSED ELECTRICAL CONDUCTORS

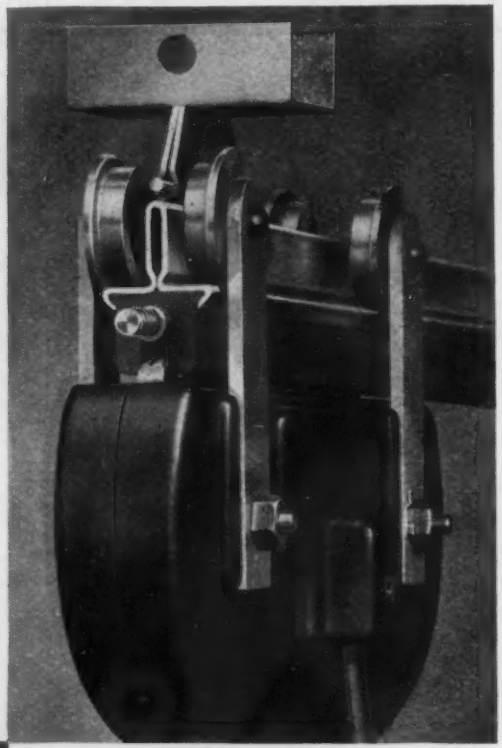
With the Fully

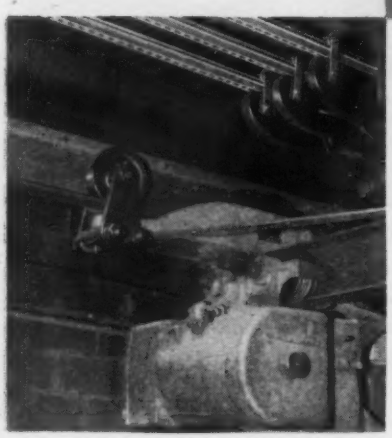
Rubber Insulated

TRAC TROLY SYSTEM

Readily installed on ALL TYPES OF Electrically Operated

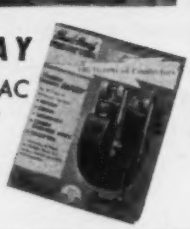
★CRANES ★TRAMCARS
★HOISTS ★MONORAILS
★MOBILE PORTABLE TOOLS





Why not thoroughly investigate the multiple savings and advantages to be secured by removing the possibility of costly accidents and fire hazards, resulting from *exposed* electric trolley wires in and around your plant. Start your investigation, today, by looking into the fully rubber-insulated TRAC TROLY System, designed for single or multiple phase A.C. or D.C. circuits up to 600 Volts. This protection is not only economical but yields large returns in increased production efficiency, lower maintenance costs and reduced compensation rates with higher earned dividends. Get full particulars without delay.

WRITE TODAY
For your copy of TRAC TROLY SAFETY Bulletin No. 201



RUBBER **BENBOW** INSULATED **TRAC TROLY**

BENBOW MANUFACTURING COMPANY
Dept. 24 Hobart Bldg. • San Francisco 4, California

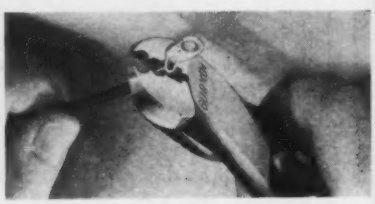
Smoke Detector (816)

A photo-electric system which detects smoke in air conditioning systems and operates warning or control mechanisms is offered by Photoswitch Inc. The system consists of the manufacturer's control Type A26 and light source type L11RX. The light source may be mounted to project a beam over any distance from 10 to 25 ft. to the photoelectric eye and a sensitivity adjustment may be set for response to smoke of predetermined density. The control is so designed that either current or tube failure will cause it to operate as though the light beam were interrupted.

The control operates on 115 volts a-c, 60 cycles and incorporates a single-pole double-throw relay for normally open or normally closed operation. Silver relay contacts are designed to handle 10 amp. a-c or 5 amp. d-c at 115 volts. When using external power, a maximum of 230 volts may be used on the contacts, providing 1,100 watts a-c or 550 watts d-c is not exceeded. Larger currents or higher voltages may be controlled through use of an auxiliary power relay.

Connectors (817)

Burndy Engineering Co. is making Hyden connectors for small-sized aluminum wires and cables. In these connectors, zinc is plated on oxide-free aluminum, and the barrel of the connector is filled with petrolatum jelly in which zinc dust is suspended. When the cable end is inserted into the



zinc-filled barrel, zinc compound is forced between the individual strands and, as the connector is indented to the cable, the zinc particles tend to break through the oxide film on each strand when the wires wipe against each other under pressure. Under laboratory tests, these connectors have shown a conductivity of 117.5%, it is stated.

Vest-Pocket Radio (818)

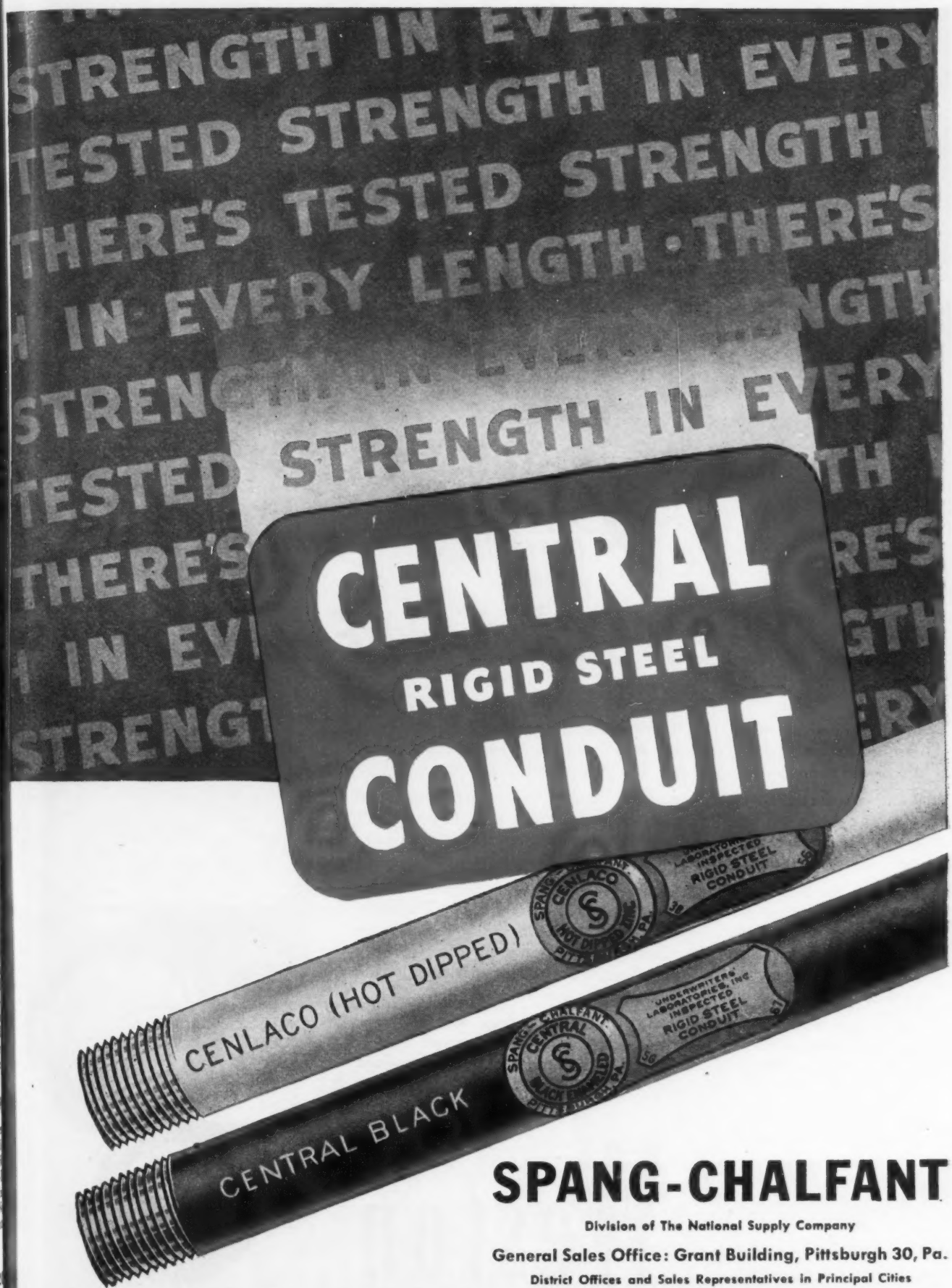
Sentinel Radio Corp. is planning production of a vest-pocket radio, which it claims will be smaller than the smallest camera or personal type radio sets manufactured prior to the war and can be operated anywhere without disturbance to anyone. Its batteries will be self contained and its aerial contained in the wire leading to the ear piece, which will be of the hearing aid type.

Circuit Tester (819)

An all-purpose, pocket type circuit tester has been designed by Amerline for indicating voltages from 90 volts d-c and 6 volts a-c to 500 volts a-c or d-c. A G-E neon lamp on the top glows in varying intensities to indicate circuit conditions. No glow indicates a dead line. The lamp lights on currents as low as one microampere.

Prewar Extinguisher (820)

General Detroit Corp. has announced that production is being resumed on its prewar copper finish soda-acid and foam type extinguishers and that units are available.

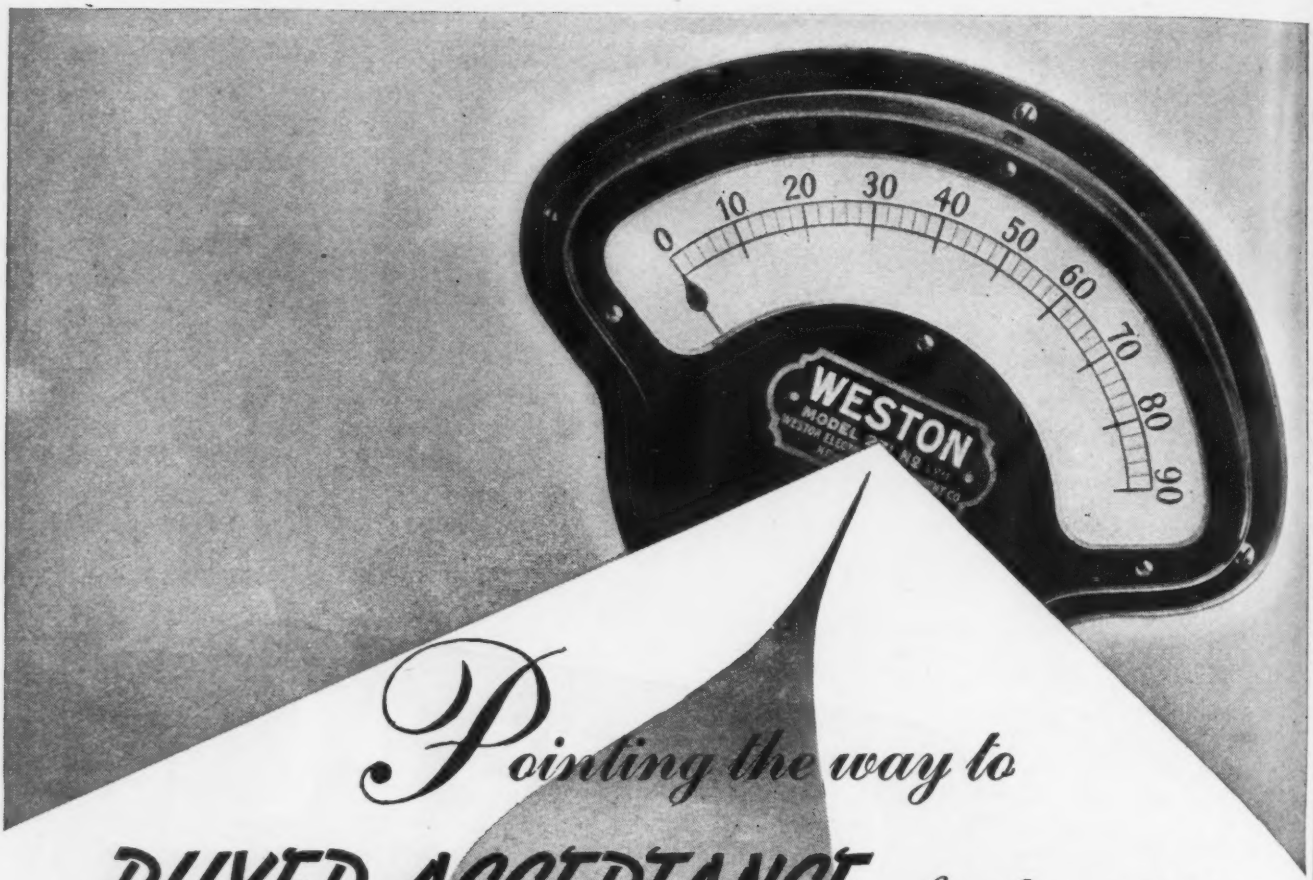


SPANG-CHALFANT

Division of The National Supply Company

General Sales Office: Grant Building, Pittsburgh 30, Pa.

District Offices and Sales Representatives in Principal Cities



Pointing the way to

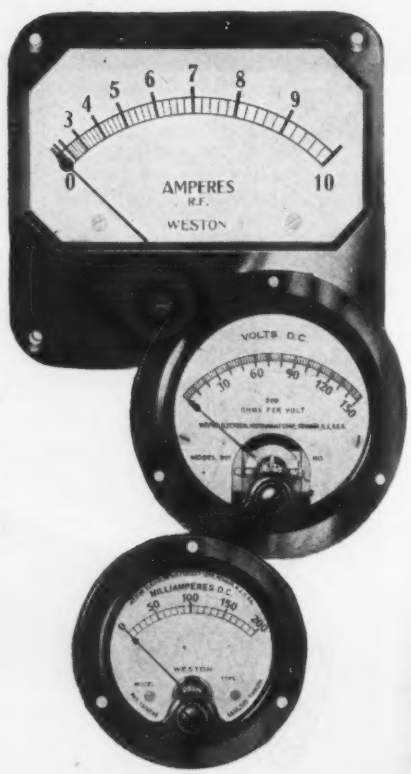
BUYER ACCEPTANCE *for tomorrow*

Many a brain-child of far-sighted companies now on the drawing-board, is destined for early birth. *Tomorrow, these products will be seeking market acceptance not only at home, but in all corners of the earth.*

With postwar markets highly competitive, manufacturers will strive to put into the product the best in materials components, and engineering skill. And if an indicating instrument is essential, it must be one not only of *proved* dependability, but one which has world-wide preference as well.

Logically, the instrument choice will be WESTON. For a WESTON on the panel gains instant recognition from equipment buyers throughout the world. To them, it is outward evidence of engineering soundness all throughout the device or machine. And to the manufacturer it brings an added sense of security . . . knowing that wherever they are used, his machines have a dependable and trouble free WESTON at the controls.

Before your equipment gets into the manufacturing stage, why not check your instrument needs with WESTON. Complete engineering service is freely offered. Weston Electrical Instrument Corporation, 577 Frelinghuysen Avenue, Newark 5, New Jersey.



Weston

ALBANY • ATLANTA • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DENVER • DETROIT • JACKSONVILLE • KNOXVILLE • LOS ANGELES • MERIDEN
MINNEAPOLIS • NEWARK • NEW ORLEANS • NEW YORK • PHILADELPHIA • PHOENIX • PITTSBURGH • ROCHESTER • SAN FRANCISCO • SEATTLE • ST. LOUIS • SYRACUSE
In Canada, Northern Electric Co., Ltd., Powerlite Devices, Ltd.

Orders are to replace 'em all with HUBBARD RIBBED CROSS-ARM BRACES!

Trouble is almost as unpredictable as the weather, especially on transmission lines exposed to the fury of the elements in isolated, mountainous and devastateous areas. When high velocity winds, heavy snows and torrential floods exert their destructive forces, maintenance crews are sorely pressed, patching up the damage. To forestall service interruptions this winter and for years to come many power companies have adapted the farsighted practice of installing the strongest and most rugged pole line hardware available. Ordinary cross arm braces are being replaced with Hubbard Ribbed Cross-Arm Braces engineered for ruggedness to gain greatest structural strength with no added weight. Too, Hubbard Braces are "pore-sealed" by Hubbard Hot Double-dip Galvanizing to give positive protection against rust and corrosion. Smooth rounded ends facilitate installation besides reducing the possibility of injuries. Why not consider this preventive maintenance program in your operation.

Boy, that'll sure cut down trouble this winter

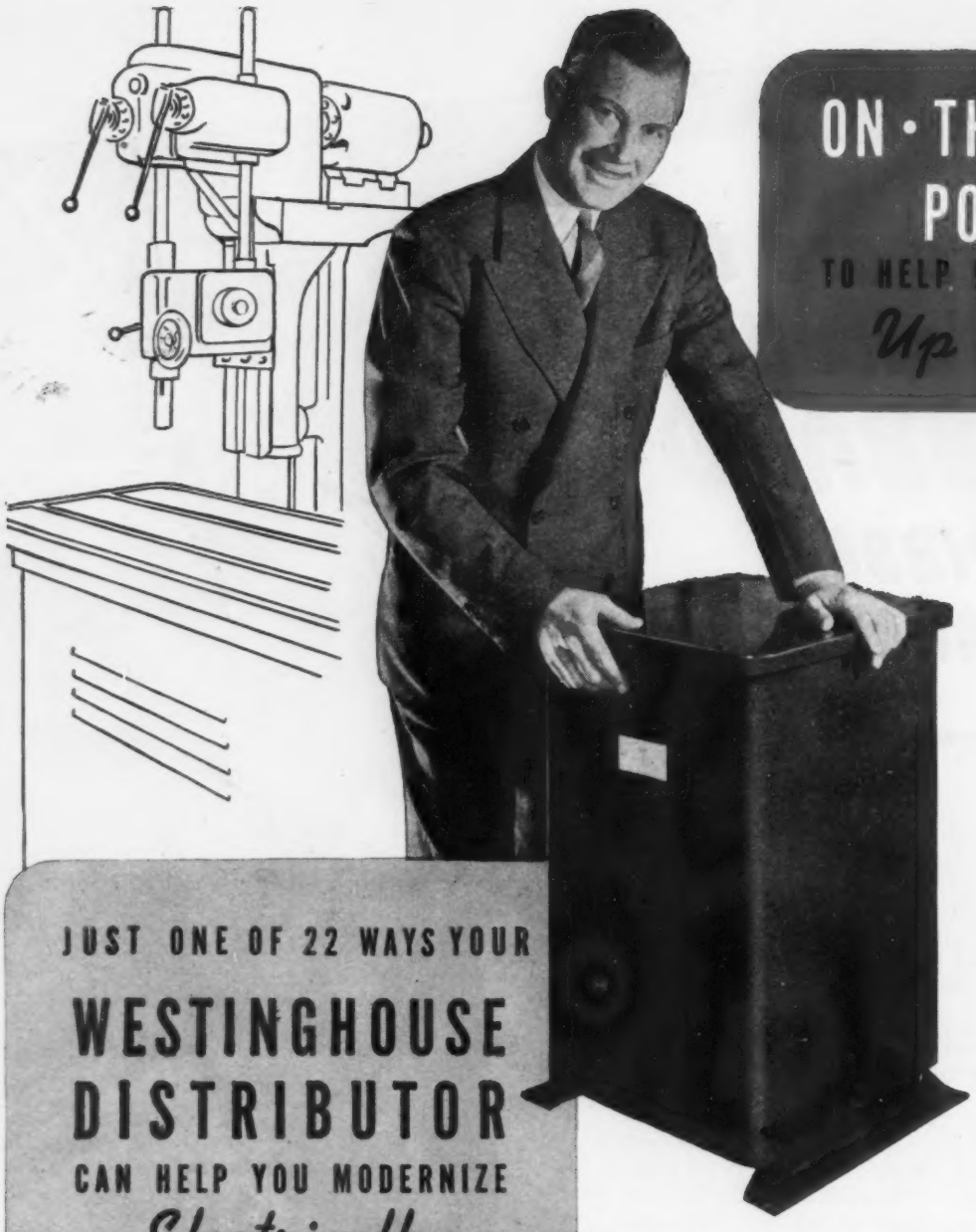
SEE YOUR NEAREST BRANCH OF GRAYBAR ELECTRIC COMPANY OR GENERAL ELECTRIC SUPPLY CORP.

HUBBARD

Hubbard and COMPANY

OAKLAND, CAL. PITTSBURGH CHICAGO

HUBBARD



JUST ONE OF 22 WAYS YOUR

WESTINGHOUSE DISTRIBUTOR

CAN HELP YOU MODERNIZE

Electrically

Sluggish motors and under-par illumination can't compete today with the new high standards of efficiency established by modern war plants. Voltage must be maintained at proper levels—power must be conveniently available when machines have to be shifted in location.

Your Westinghouse Distributor has the solution to this problem, in handy, lightweight Westinghouse Dry-Type Transformers. Smallest and lightest indoor distribution transformers ever built, these units offer three important benefits:

1. *Space saving*—dry-type transformers mount anywhere, on platform, column or overhead.
2. *Cost and time saving*—no fireproof vaults required (subject to state regulations). Fire and explosion hazards are completely eliminated.
3. *Improved voltage regulation and copper saving*—located at the load, these transformers eliminate long, heavy secondary runs.

Check your Westinghouse Distributor today . . . find out how these and other electrical modernization aids can help you bring war-worn motors and machines up to par.

J-70448

TWENTY-ONE OTHER WAYS your Westinghouse Distributor can help you in planning electrical modernization, whether for a single department or for your entire plant, are suggested in this new book. It provides a check list on modern electrical practices, from incoming power to methods of utilization and control. Ask your Westinghouse Distributor today for a copy of B-3476. Or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Let's cross these rivers before we come to 'em!

RIVER development and flood control rank high on the list of America's post-war plans. Many of these projects call for dams which may also produce electric power.

This involves issues that should be discussed and settled now—*rivers to cross in advance.*

Many of us in the power business have had a long experience with riverside plants, in the production of both steam-generated and hydro-electric power. In fairness to all taxpayers and in the interest of the many million users of electricity, we think we ought to outline our convictions and suggestions on river development and flood control.

1 When a dam is proposed, all of its purposes should be clearly defined in the legislation — flood control, navigation, irrigation or power. And just as clearly, the benefit to the people affected should justify the cost.

2 If power is produced at government-built dams, it should be sold to existing power systems, without special privilege or discrimination. This will save the expensive duplication of transmission facilities, help to co-ordinate the entire power supply of each region, and assure its widest possible use at the lowest practical rates.

3 Any savings made possible by this plan should be passed along to the users of electricity, under regulation by State Commissions or other properly constituted regulatory bodies. This will assure all the benefits of river development and hydro-power without the added expense of government going into business and competing with its own citizens.

4 Government in *any* business endangers *all* business. Government in business escapes many normal business obligations, enjoys free mail, pays no federal taxes, and few, if any, other taxes, little or no interest. If government can sell electricity on this basis, it can sell shoes, groceries, automobiles, or anything else the same way. Government may properly *regulate* business in the public interest but should not *operate* business. It should not play in the game for which it makes the rules. In other words, *government should not try to be umpire and pitcher at the same time!*

167 ELECTRIC LIGHT AND POWER COMPANIES*

*Names on request from this magazine.

SELF-SUPPORTING, TAX-PAYING BUSINESSES

NOW! More Facts G·E CIRCLINE

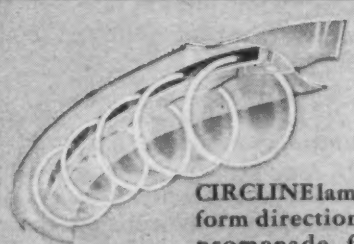
Development of circular fluorescent lamps by General Electric Lamp Research opens up many opportunities for new lighting business in all the major lighting markets. Here, for the first time, is the technical data on the 12-inch G-E CIRCLINE Lamp. Data on two additional circular F lamps (8½″ and 16″ outside diameter, respectively) will be announced later. *Samples are not yet available* but will be distributed at the earliest possible moment. Quantity production will begin as soon as conditions permit. Ballasts, starters and connectors are in process of development. Data will be available through the usual channels.

Suggested combination of CIRCLINE and incandescent lamp in portable lamp.

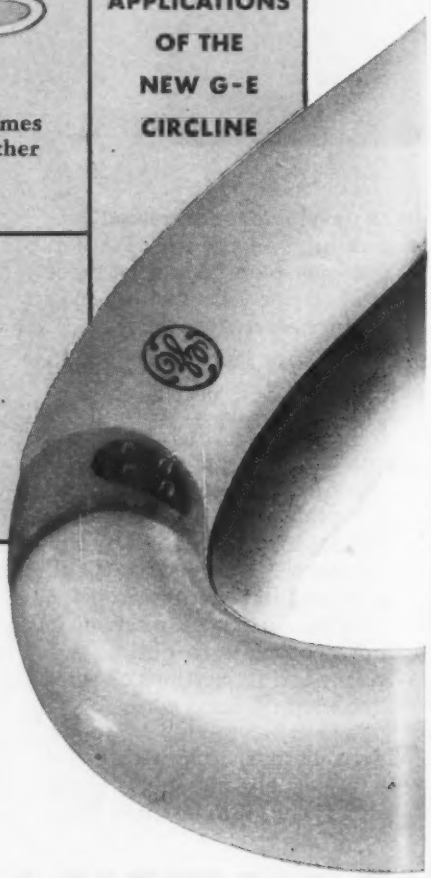
Idea for ceiling fixture for homes and for stores, theaters and other commercial applications.

TYPICAL APPLICATIONS OF THE NEW G-E CIRCLINE

CIRCLINE Lamp furnishes diffused lighting in this idea for machine tool illumination.



CIRCLINE lamps form directional promenade for stores in this suggestion.



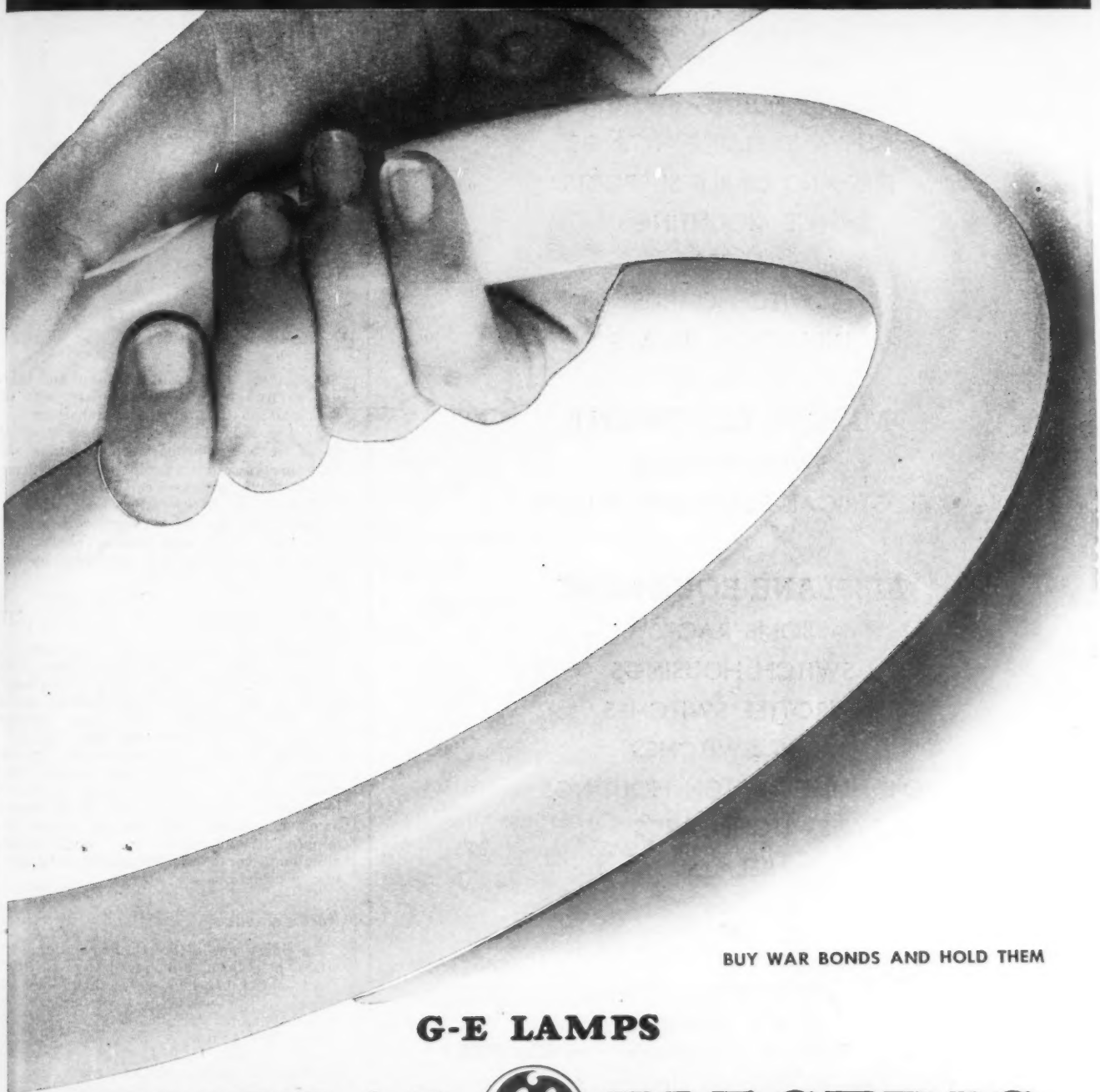
APPROXIMATE DATA FOR 12″ G-E CIRCLINE LAMP

Lamp Watts	32 Watts
Outside Diameter of Circle	12″ ± ¼″
Diameter of Tube	T-10 (1¼″)
Lamp Amperes (operating)	0.42—0.43 Amps
Lamp Volts (operating)	84-86 Volts
Type of Base. . . . 4 Pin	2 pins for each end of tube to provide for cathode preheat)
Light Output (estimate) (White)	1600 Lumens
Brightness—Foot-lamberts (estimate)	2040 Foot-lamberts
Candles/sq. in. (estimate)*	4.5 Candles/sq. in.

Early test data indicate a rated life corresponding to the standard 40-watt T-12 fluorescent lamp.

** Brightness integrated across the tube diameter in the center of the tube.*

about the New Fluorescent Lamp



BUY WAR BONDS AND HOLD THEM

G-E LAMPS

GENERAL ELECTRIC

Cole Electric Co.

1510 South Los Angeles Street
PRospect 2068
LOS ANGELES 15, CALIFORNIA

•

POWER PLANT EQUIPMENT

AIR BREAK SWITCHES
MANUALLY OPERATED

AIR BREAK SWITCHES
MOTOR OPERATED

DISCONNECTING SWITCHES

BUS AND CABLE FITTINGS

BUS AND CABLE SUPPORTS

FUSE MOUNTINGS

FUSES

SWITCHBOARDS

INDUCTION RELAYS

MARINE EQUIPMENT

SWITCHBOARDS

ELECTRICAL EQUIPMENT RELAYS

AIRPLANE EQUIPMENT

BOMB RACKS

SWITCH HOUSINGS

THROTTLE SWITCHES

LIMIT SWITCHES

OIL FILLED SWITCH HOUSINGS

SWITCHBOARDS

RELAYS

•

Pacific Coast Representatives

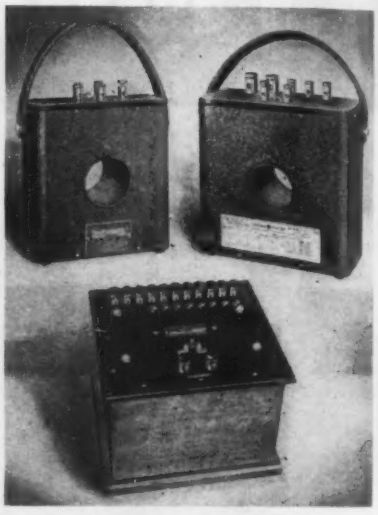
EICHER & BRATT
Colman Bldg., Seattle 4, Washington • • Eliot 2722

EARL S. CONDON COMPANY
357 S. Hill St., Los Angeles 13, Calif. • • MI. 2831

Current Transformers (821)

General Electric has a new line of portable current transformers for use on circuits up to 2,500 volts. Designated Types JP-2, -3, -4, they are multi-range units, with Type JP-2 also available as a single-range unit.

JP-2 and -3 are of through-window type construction and are said to meet accuracy requirements of the ASA 0.3 accuracy class with burdens B-0.1, -0.2 and -0.5 at 60 cycles. JP-2 is not supplied with a primary winding but there is a hole in the core through which a cable or conductor can be passed. JP-3 is designed with a combination of wound-primary and through-primary



construction. Ratings of 100 amp. and below are secured by a wound-primary with the terminals on the top of the transformer.

JP-4 is designed for a laboratory standard. It is of wound-primary construction with taps in the primary coil for the different ratios. Each primary coil, 0.25 to 15, is protected by a removable fuse. The secondary terminals are provided with a short-circuiting switch and with a Thyrite protector to guard against accidental opening of the secondary circuit.

Electric Marker (822)

An electric marker, built on a new design, has been announced by Ideal Commutator Dresser Co. According to the manufacturer, the power of the cutting stroke has been increased 30% over previous models, and an adjusting nut has been provided to vary the impact for use on glass. The tool operates from any a-c electrical outlet. It is six inches long, ten ounces in weight, and operates like a small electric hammer, making 7,200 cutting strokes per minute. It will mark iron, steel, bronze, aluminum, ceramics, tile, marble, lead, plastics, porcelain, glass, etc.

Rectifier Tube (823)

An inert gas-filled rectifier tube, Type 3B28, has been announced by Chatham Electronics Co., which states that it was designed to operate over wide variations of ambient temperature without the use of temperature control devices. Ratings: Peak inverse voltage, 10,000 volts, peak plate current, 1.0 amp., average plate current, .250 amp., tube voltage drop, 10 volts. Filament current is 5.0 amp. at 2.5 volts. At 500 cycles or less, the peak inverse voltage rating is 6,500 volts at 2 amp. peak plate current, .5 amp. average plate current.

C-D CAPACITORS

RAISE SYSTEM VOLTAGE LEVEL

INCREASE CURRENT CAPACITY

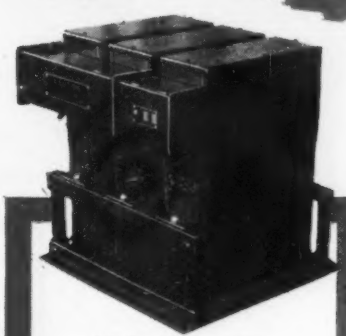
CURE HOT FEEDERS —BLOWN FUSES

Cornell - Dubilier Dykanol Capacitors through power-factor improvement will increase the load-carrying capacity of your present system quickly, economically, prevent trouble and break-downs. This manufacturer's experience is typical . . . . . .

At a Mid-West plant, 200 additional motors caused power-factor to drop 53%, motors, feeders, switchboard ran hot, main line fuses blew several times a week—all costly in interrupted production

A bus duct installation of C-D Capacitors increased power-factor to 85%, the line current for the same load was reduced from 1040 to 675 amperes, overheating and fuse trouble were cured. Voltage level throughout the plant was improved and power-factor was maintained at power contract level.

Compact, flexible, easily installed, C-D Capacitors can be hung at one place or as many places as needed, mounted on ceiling, floor or wall, or moved along the duct, plugged in with standard plugs. Long after installation, C-D's continue to prove their value as an investment. Let our engineers survey your plant and estimate on the advantages of C-D Capacitors for your power-factor requirements. Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.



C-D Type DB capacitor

SEND FOR C-D's TIME-SAVING VECTOR CHART *for determining capacitor KVAR required to increase power-factor to any desired value.* **FREE ON REQUEST.**

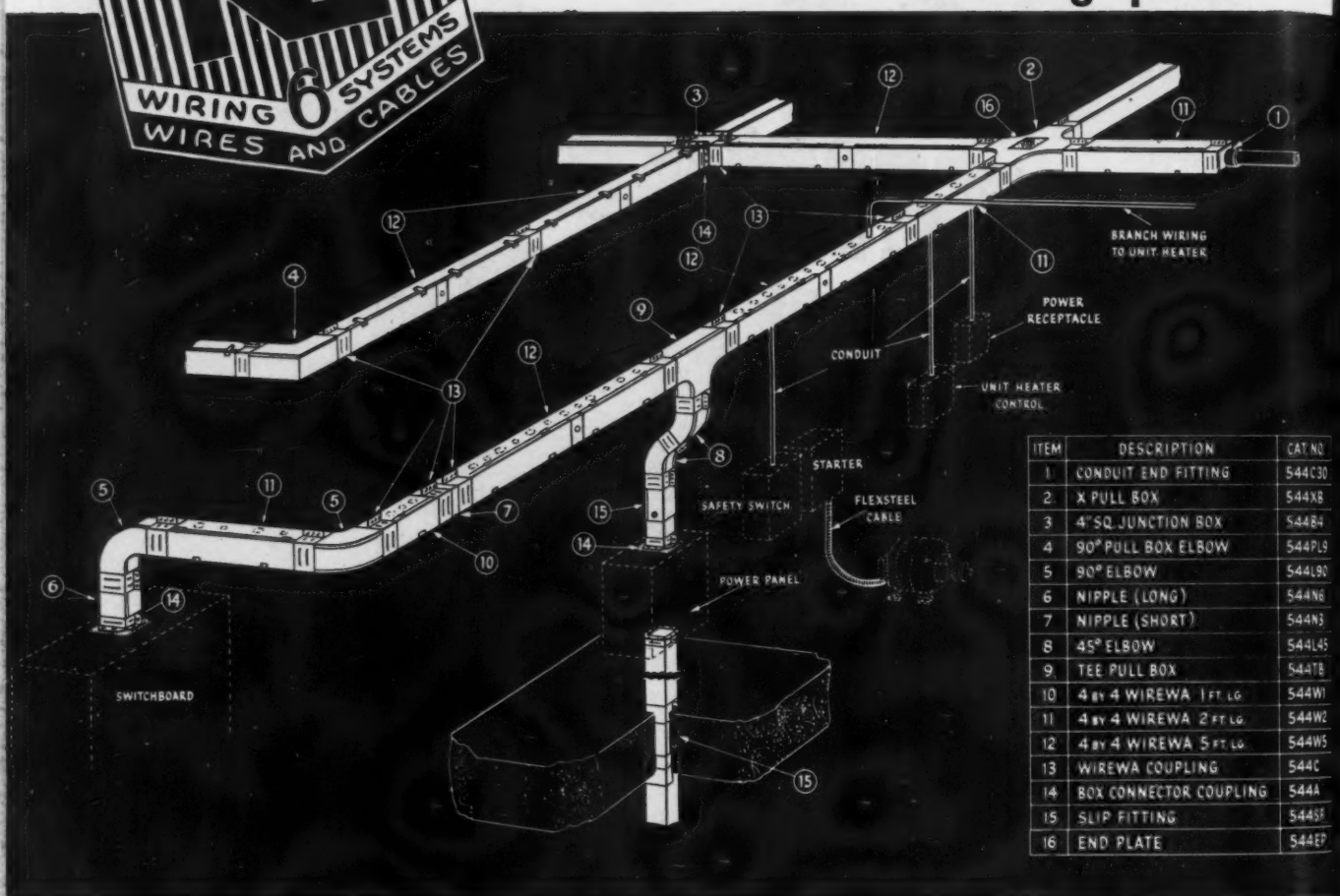
Cornell-Dubilier Capacitors

FOR POWER-FACTOR IMPROVEMENT

CARRIER CURRENT COUPLING • SURGE PROTECTION

Specify National Electric "4x4 WIREWA" for industrial extensions and rewiring jobs

NATIONAL ELECTRIC PRODUCTS
WIRING SYSTEMS
WIRES AND CABLES



ITEM	DESCRIPTION	CAT. NO.
1	CONDUIT END FITTING	544C30
2	X PULL BOX	544XB
3	4" SQ. JUNCTION BOX	544B4
4	90° PULL BOX ELBOW	544PL9
5	90° ELBOW	544L90
6	NIPPLE (LONG)	544N6
7	NIPPLE (SHORT)	544N3
8	45° ELBOW	544L45
9	TEE PULL BOX	544TB
10	4 BY 4 WIREWA 1 FT. LG.	544W1
11	4 BY 4 WIREWA 2 FT. LG.	544W2
12	4 BY 4 WIREWA 5 FT. LG.	544W5
13	WIREWA COUPLING	544C
14	BOX CONNECTOR COUPLING	544A
15	SLIP FITTING	544SF
16	END PLATE	544EP

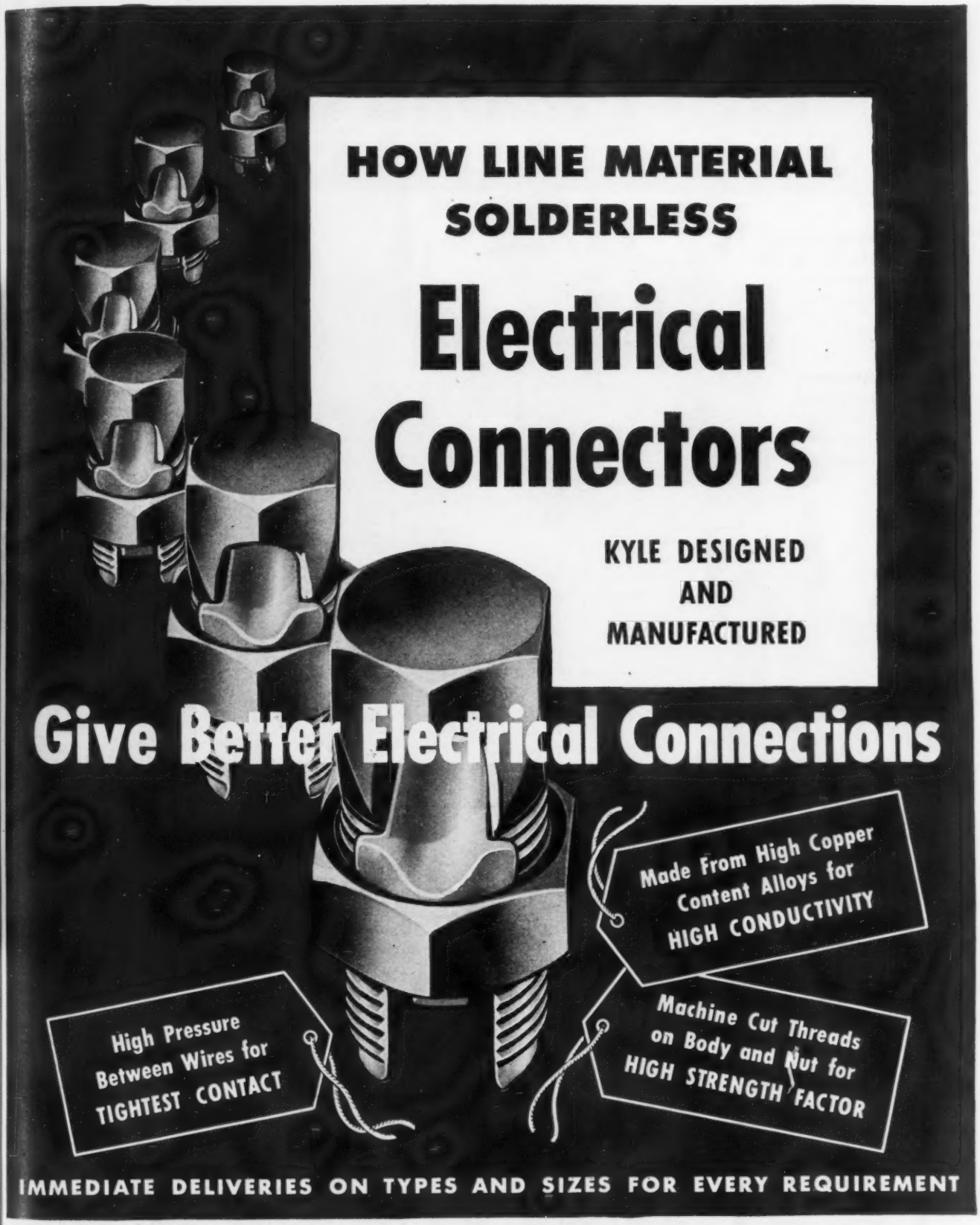
(sketch of a 4x4 WIREWA installation showing complete flexibility, simplicity and use of fittings.)

For housing of plant power systems and extension and rewiring of lines up to 600 volts, specify National Electric 4x4 WIREWA. Complete, easy to install, providing an area of 16 square inches and permitting an unusually high degree of flexibility and accessibility, this system has found wide acceptance in a variety of plants. Write for descriptive literature. National Electric also manufactures a complete line of wires and cables—famous for their long service and saving of space.

A FEW MAJOR REASONS WHY THE NATIONAL ELECTRIC 4 x 4 SYSTEM IS SO POPULAR

- Maximum usable space permitting greatest number of wires.
- Ease of installation and accessibility for tapping, rerouting, etc., without disturbing existing installation.
- Greater flexibility to meet specific local conditions.
- May be mounted direct to wall or by means of standard hangers suspended from the ceiling.

National Electric Products Corporation
Pittsburgh, Pa.


HOW LINE MATERIAL SOLDERLESS
Electrical Connectors
KYLE DESIGNED AND MANUFACTURED
Give Better Electrical Connections
Made From High Copper Content Alloys for HIGH CONDUCTIVITY
High Pressure Between Wires for TIGHTEST CONTACT
Machine Cut Threads on Body and Nut for HIGH STRENGTH FACTOR
IMMEDIATE DELIVERIES ON TYPES AND SIZES FOR EVERY REQUIREMENT
MADE BY KYLE CORPORATION SOUTH MILWAUKEE WISCONSIN

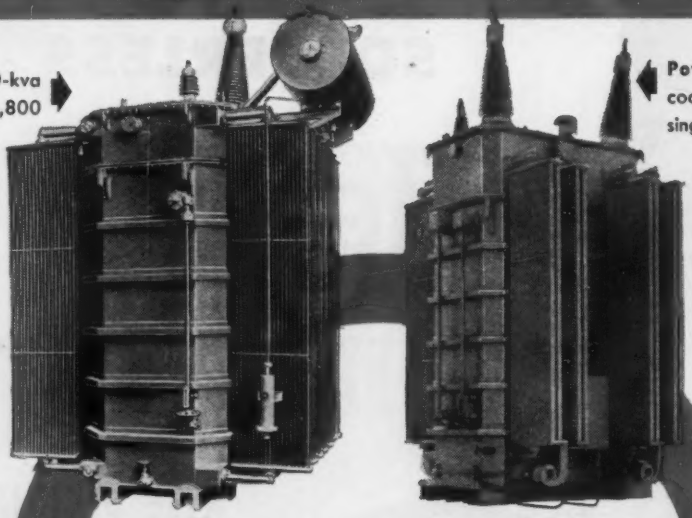
Wagner
MAKES A COMPLETE LINE OF POWER TRANSFORMERS

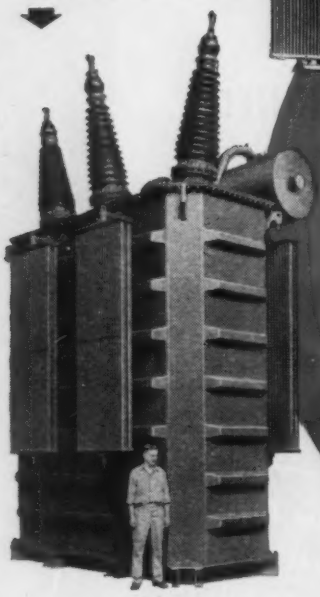
Power Transformer—12,500-kva self-cooled, 138,000Y to 13,800 volts, single-phase, 60 cycles. Built for a war plant.

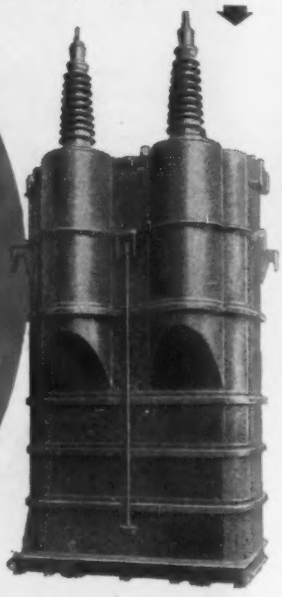
Power Transformer—7500-kva self-cooled, 10,000-kva forced-air-cooled, single-phase, 3-winding, 60 cycles. Hv 110,000Y—Lv 46,000Y—Tv 12,000 delta. Built for use by a power company.

Power Transformer—3000-kva self-cooled, 161,000 delta to 13,800Y volts, 3-phase, 60 cycles. Built for a power company.

Power Transformer—16,000-kva water-cooled, 110,000Y to 13,800 volts, single-phase, 60 cycles.



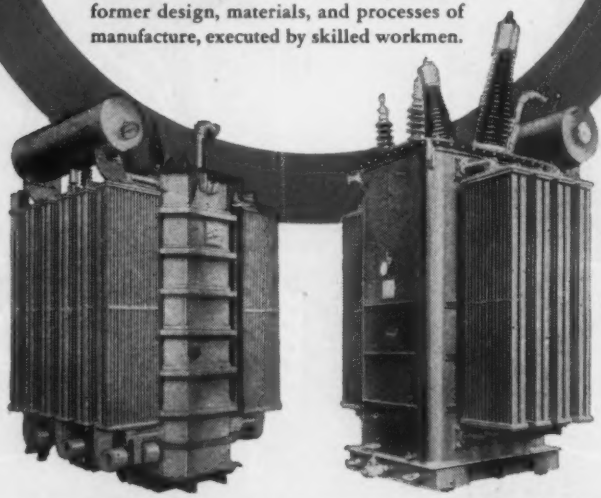




EVERY power transformer purchaser, of course, has specific needs which must be met. Therefore the complete line of Wagner power transformers has been designed with this in mind. Various parts and the methods of fabricating them have been standardized, but their final assemblies vary as each individual customer's requirements dictate.

Every power transformer in Wagner's complete line is built to maintain the reputation for giving unfailing service. This reliable service has been maintained throughout the years due to Wagner's policy of always utilizing the latest developments in transformer design, materials, and processes of manufacture, executed by skilled workmen.

Power Transformer—10,000-kva self-cooled, 13,333-kva forced-air-cooled. 33,000 delta to 2400 volts, delta, 60 cycles, 3-phase. Built for a power company.



Power Transformer—4000-kva, 69,000 to 2400 volts. 115,000 volts, oil-filled, h. v. bushings equipped with 69-kv coordinating gap.

Write for Literature

Bulletin TU-181, which gives full information concerning Wagner power transformers, will gladly be sent to you on request.

TRANSFORMERS
are but one of several WAGNER PRODUCTS serving industry.
Other WAGNER PRODUCTS:
AIR BRAKES
•
BRAKE LINING
•
HYDRAULIC BRAKES
•
INDUSTRIAL BRAKES
•
INDUSTRIAL BRAKE CONTROLS
•
NoRol
•
TACHOGRAPH
(Recording Speedometer)
•
ELECTRIC MOTORS

T45-21

THESE 29 SALES AND SERVICE BRANCHES ARE READY TO SERVE YOU

ATLANTA 3 • BALTIMORE 18 • BOSTON 15 • BUFFALO 8 • CHICAGO 16 • CINCINNATI 10 • CLEVELAND 15 • DALLAS 1
DENVER 2 • DETROIT 2 • HOUSTON 2 • INDIANAPOLIS 4 • KANSAS CITY 8 • LOS ANGELES 15 • MEMPHIS 3
MILWAUKEE 2 • MINNEAPOLIS 4 • NEW YORK 7 • OMAHA 2 • PHILADELPHIA 8 • PITTSBURGH 13 • PORTLAND 9
ST. LOUIS 3 • SALT LAKE CITY 1 • SAN FRANCISCO 3 • SEATTLE 4 • SYRACUSE 2 • TULSA 3 • WASHINGTON 5

Wagner Electric Corporation

ESTABLISHED 1891
6381 Plymouth Avenue, St. Louis 14, Mo., U. S. A.
In Canada: Wagner Electric at Leaside, Ontario
ELECTRICAL AND AUTOMOTIVE PRODUCTS

"Better I shoulda stood in bed"

• You said a mouthful, mister! This is no summer for idle travel—and we aren't just talking patriotism . . . we're talking sense! If you're the rugged type that doesn't mind long station waits, crowded trains, sitting up or standing up all night, train-long lines for the diner . . . then go right ahead with that vacation trip. But if you're smart, you'll give those furloughed G.I.'s a chance, and spend a lazy, lovely couple of weeks close to home, where the swimming's better, the fishing and golf are just as good, the food is *much* better, and your conscience won't ache every time you see a uniform. *This* summer, the trains belong to those kids in uniform. Unless your trip will help them win the war—STAY HOME!

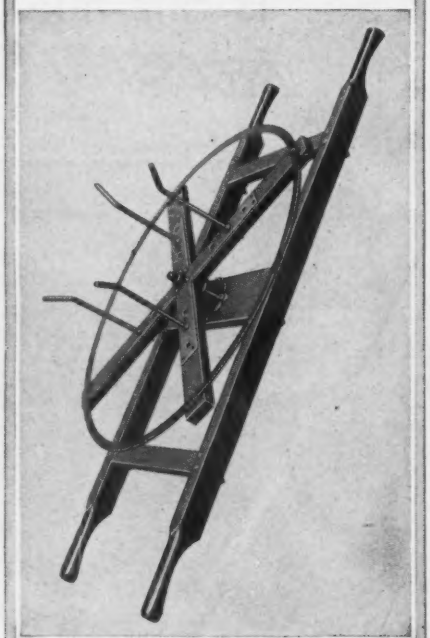
• As with our entire production facilities—now with our advertising—Railley's energies are single-mindedly devoted to America's War Effort.

Railley
CORPORATION · CLEVELAND, OHIO
ORIGINATORS OF THE
PIN-IT-UP LAMP

Now Making for Victory: X-RAY PARTS • GAS PROOF COVERS
ROCKET PROPULSION UNITS • DUMMY FUZES • PRACTICE CARTRIDGES

MATTHEWS WIRE REEL

a reel at low cost



Catalog 17-A Matthews Wire Reel is an inexpensive yet efficient tool for paying out or taking up wire. It is of sturdy construction and can be used for heavy as well as light work. The frame and cross members of turn table are of durable white oak and base, flange and coil arms are of cast malleable iron. Turn table revolves very easily with full coil of wire. Coil arms can be adjusted for coils of wire having inside diameters of 12, 18 and 24 inches. Complete reel finished in olive drab enamel. Base casting and turn table only, can be furnished for truck mounting or store room installation. Frame 70" long x 24" wide, overall height 19", diameter of turn table 42".

PRICE — $23.00 EACH

Prepaid in U. S. A.

Lower Prices in Quantities

W. N. MATTHEWS CORPORATION

SAINT LOUIS 8, MISSOURI

BULLETINS

data books, etc.

Magnets (824)

Sintered-alnico magnets are discussed in a 20-page bulletin prepared by General Electric. Construction and application data are given, as well as magnetic and mechanical properties. Twelve pages are devoted to catalogue information on standard forms of G-E alnico magnets.

Ball Bearings (825)

New Departure division of General Motors Corp. has prepared a new booklet in its series for designers, a 24-page manual on ball bearings. This booklet has 78 drawings and charts, and covers fundamentals of bearing mounting, preloading methods, bearing creep, etc.

Turbine Pumps (826)

Fairbanks Morse & Co. has issued a bulletin on its Figure 6920 oil-lubricated motor-driven turbine pumps with enclosed impellers. Construction details are illustrated and sizes and ratings are given. Turbine pump selection also is treated.

Power Factor (827)

A 20-page bulletin, "The A B C of Power Factor", has been published by Electric Machinery Mfg. Co. It defines power factor, tells why low power factor is detrimental, how to get high power factor and how to make power factor calculations.

Catalogue (828)

Wagner Electric Corp. describes briefly its line of electrical and automotive products in a 16-page folder recently released. Motors, transformers, industrial brakes and controls are among the products included.

Speaker (829)

Altec Lansing Corp. is offering a bulletin on its new Duplex speaker for home radio, monitoring, public address systems, phonograph and F-M reproduction. It combines high- and low-frequency units in a two-way multi-cellular loudspeaker.

Temperature Control (830)

Precision Scientific Co. has prepared a catalogue on its temperature control cabinets, including standard and custom built models. Descriptive data, illustrations and prices are included.

Lathes (831)

South Bend Lathe Works has issued catalogue 9-G, covering its line of nine-inch engine and toolroom lathes. Accessories, motors and controls are described.

Frozen Foods (832)

"Are Frozen Foods Nutritious?", an article by Dr. Donald K. Tressler originally appearing in "Forecast for Home Economists", has been reprinted by General Electric.

Panels, Cubicles (833)

Falstrom Co. has a new six-page catalogue on its panel and cubicle installations. Custom-built assemblies are among those illustrated.

Personnel Practices (834)

A booklet outlining its personnel practices has been published by Ilg Electric Ventilating Co.

F Luminaire (835)

Pittsburgh Reflector Co. has a data sheet on its fluorescent luminaire, the Jefferson No. 1240.

Resistors (836)

A 32-page resistor catalogue has been published by Ward Leonard Electric Co., giving types, sizes, resistance values, mountings and enclosures.

Tachometers (837)

General Electric has a new 12-page bulletin on its line of electric tachometers.

ELECTRICAL WEST, 68 Post St., San Francisco, 4, California
Please send me information about following CIRCLED items:

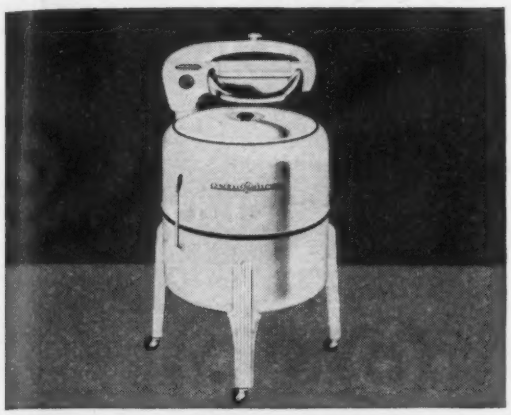
800	801	802	803	804	805	806	807	808	809	810
811	812	813	814	815	816	817	818	819	820	821
822	823	824	825	826	827	828	829	830	831	832
833	834	835	836	837						

Name..... Company*..... Title*.....

Address.....

* Please include your company's name and your position, as we cannot ask manufacturers to furnish literature unless you do.

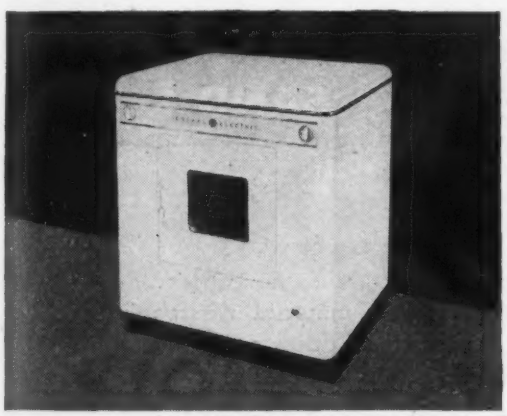
NOW! Get in the Home Laundry Business with the Complete G-E Line!



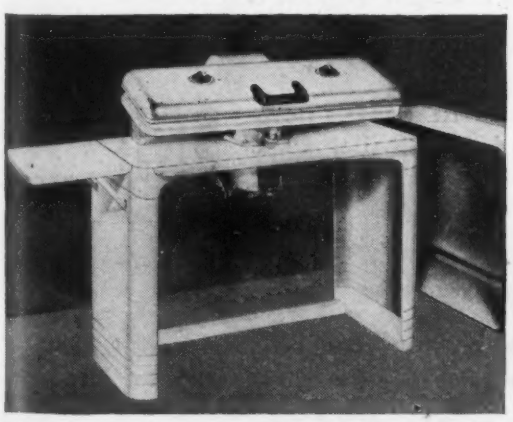
G E Washer — One-Control Wringer! Maximum safety and convenience. Even pressure—can be "set" for any fabric. "Permadrive Mechanism." Only 4 moving parts. Little to wear. Needs no oiling.

Gentle "Activator Action." Thorough, but always easy on clothes!

Streamlined styling. White baked enamel finish, rust-resistant. Welded legs. Fast-drain.



G E Dryer —New! Dries clothes *indoors*, rain or shine, and does it in a jiffy. Gentle "tumbler" action, thermostatically controlled. Stops automatically. A marvelous new G-E convenience, with a *big* waiting market!



G-E Ironer — The "sit-down-and-iron" Automatic Flatplate Ironer! Easy to operate. Automatically controlled heat. Turns out big ironings quickly, beautifully. 300-square-inch board permits ironing *two* flat pieces at once!

General Electric is back in home laundry production again!

For three years the G-E Home Laundry factory has been turning out vital war weapons. We're still turning them out. But Uncle Sam has told us we can make washers, ironers, and dryers for the home front.

The sales-sensational G-E One-Control Wringer Washer is beginning to roll out of the factory now. You'll get yours SOON. The complete line will be in your store at the *earliest possible date.*

Greatest Market in History

WPB says 4,621,000 people want washers. Surveys show that 53 out of 100 women believe General Electric makes the best electrical appliances for the home.

Get set *now* to cash in on this tremendous market by featuring an ensemble laundry sale—G-E Washer, Ironer, and Dryer.

And—yes—there's a new G-E Automatic Washer coming! We honestly believe it will revolutionize the automatic washer business!

Send for the Self-Starter Package

All the sales promotion material you need is ready to go!

Tell your distributor you want the General Electric Home Laundry Equipment Self-Starter Package. In it are striking folders, displays, sales training helps. Order yours *today* from your G-E Distributor! General Electric Co., Appliance and Merchandise Dept., Bridgeport, Conn.

Tell your customers to listen to Art Linkletter, in "The G-E House Party," every afternoon, Monday through Friday, 4 p. m., E.W.T., CBS, telling millions of women about G-E Home Laundry Equipment.

FOR FINAL VICTORY—BUY AND HOLD MORE WAR BONDS

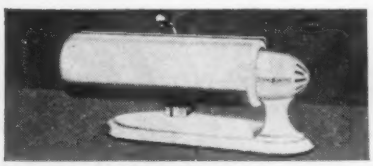
"The Appliances Most Wanted By Most Women"

GENERAL ELECTRIC

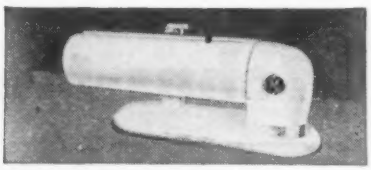
WE'RE TELLING WOMEN THE G-E HOME LAUNDRY STORY!

With hard-selling advertisements, that reach city women and farm women all over America. Every month, color advertisements appear as follows:

Collier's—Mar. 17, May 12, June 30, Aug. 4, Sept. 1, Nov. 24, Dec. 15; *Woman's Home Companion*—Feb., April, June, Aug., Oct., Dec.; *Parents'*—Jan., Feb., May, July, Sept., Nov.; *Farm Journal*—Mar., June, Aug., Sept., Dec.



G-E Portable Rotary Ironer at a low price! Weighs only 33 pounds, but does a full-size job. Women love it! A price leader!



New! G-E Automatic Portable Rotary Ironer Brand-new addition to the G-E Home Laundry line! Light and easy to carry. Fully automatic. To sell at a bargain list!

HERE'S a ductway which effectively withstands the corrosive action of all types of soil normally encountered in cable installation.

This advantage of Transite Ducts is shown in a series of tests conducted over a two-year period by an independent research agency. Through cinder fills, salt marshes, peat bogs, clay, loam and many other aggressive soils, laboratory men found that these asbestos-cement ducts actually became stronger, more durable with age.

As an added factor, underground cables encased in Transite are *cooler* cables because this inorganic material dissipates heat more rapidly than ducts with an organic content. Thus cable life is lengthened.

The permanently smooth bore of Transite Ducts makes long cable pulls easy and speeds up replacements. These ducts come in long, lightweight lengths, easy to handle and install.

* * *

For details, write for Data Book, DS410, Johns-Manville, 22 E. 40th Street, New York 16, N.Y.

JOHNS MANVILLE JM PRODUCTS

Johns-Manville

There is an office near you

TRANSITE DUCTS

CONDUIT for use without concrete

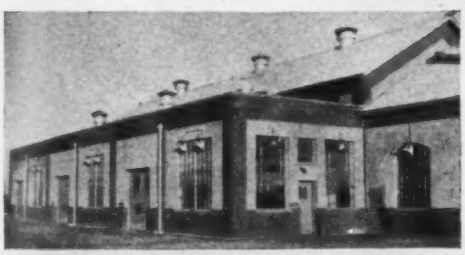
KORDUCT for concreting in

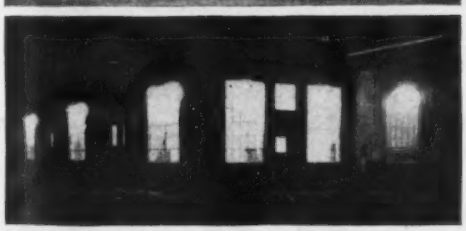
You can solve many difficult lighting problems with

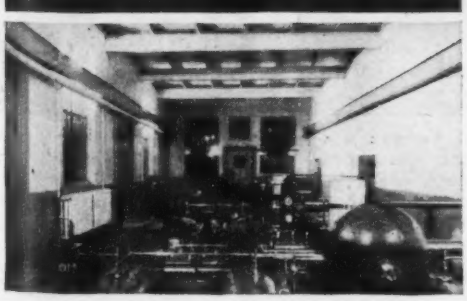
CROUSE-HINDS

high-efficiency FLOODLIGHTS

Type ADE
Heavy Duty Floodlight



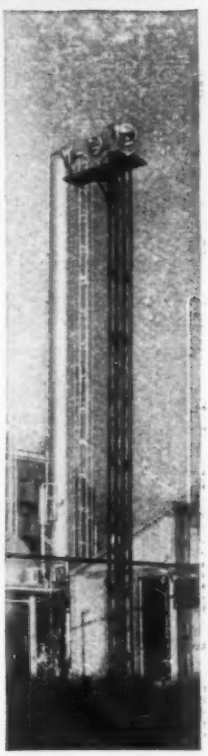




Above: **Installation showing the use of Crouse-Hinds Type ADE heavy duty floodlight for general illumination, together with Type VAW obstruction lights for air markers.**

Left: **Installation showing the use of Crouse-Hinds Type ADE heavy duty floodlights outdoors, for lighting an interior in an extremely hazardous location where no electric wiring was used within the building.**

Right: **Installation of Crouse-Hinds Type ADE heavy duty floodlights on a steel tower for general illumination.**



Medium or long range.

Weatherproof and dust-tight cast aluminum alloy housings.

***Alzak reflectors** with mirror finish — your choice of narrow or wide beam.

Heat-resisting lens. Plain, spread or diffusing.

Focusing mechanism. Operates from outside of housing.

Sizes. 12, 14, 16, 20 and 24-inch floodlights. 200 to 2000 watts.

Several mountings to meet various conditions.

Crouse-Hinds also have a complete line of Light Duty Floodlights that provide adequate light at minimum first cost, and Explosion-Proof Floodlights for use in hazardous interiors.

CROUSE-HINDS COMPANY

Syracuse 1, N. Y., U.S.A.

*Alzak is a registered trade mark of the Aluminun Company of America.

Offices: Birmingham—Boston—Chicago—Cincinnati—Cleveland—Dallas—Denver—Detroit—Houston—Kansas City—Los Angeles—Milwaukee—Minneapolis—New York Philadelphia—Pittsburgh—San Francisco—Seattle—St. Louis—Washington. *Resident Product Engineers:* Albany—Atlanta—Buffalo—Charlotte—New Orleans
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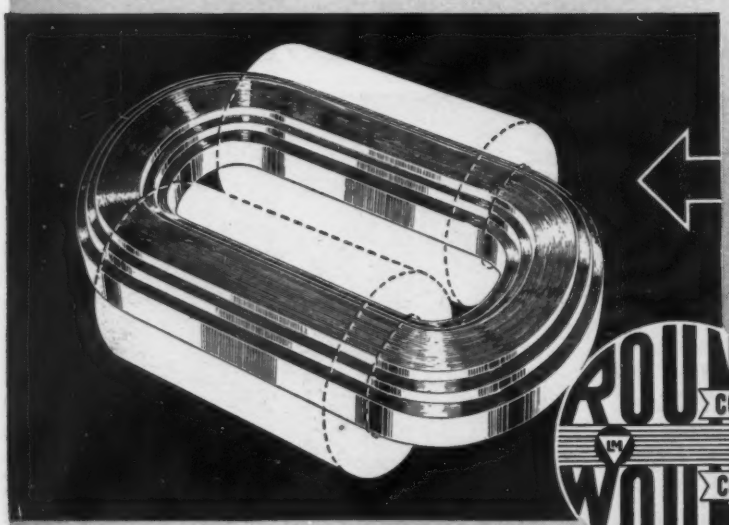
CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS

What every utility about L-M ROUND-WOUND

How they're designed



THE WOUND CORE

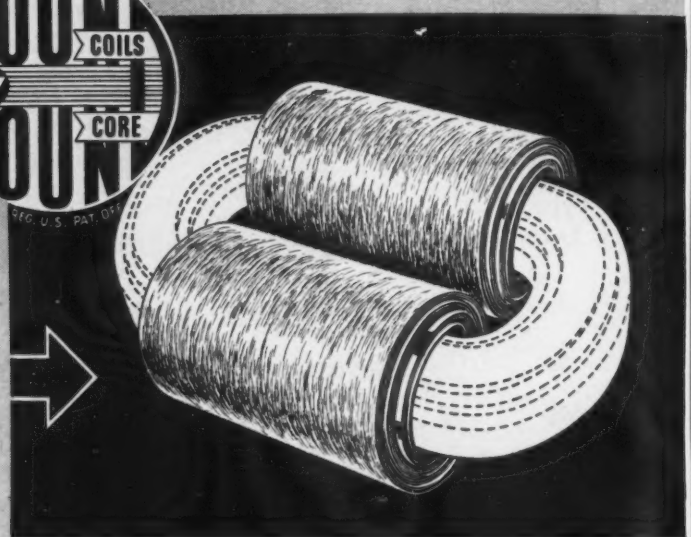
Core wound under tension, "with the grain," in elliptical shape closely approaching perfect magnetic flux movement.

Practically no air gaps—reduces exciting current substantially.

Core not relaminated, rewound, or cut in sections after annealing. Result: stable characteristics.

Cruciform cross section permits free and easy circulation of cooling oil, giving low temperatures.

ROUND COILS L-M WOUND CORE REG. U.S. PAT. OFF.



THE ROUND COILS

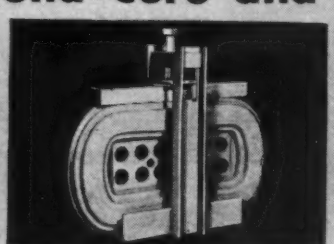
Coils are wound directly onto core, eliminating all necessity for disturbing core after it has been formed and annealed.

No air spaces between layers; correct ratio of coil length to thickness; reduces leakage flux, results in low reactance.

Further cooling is provided by oil duct spacers wound into the coil during winding. Prevents hot spots in the coil.

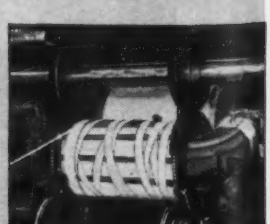
How Wound Core and Round Coils Are Made

Silicon-steel strip of varying width is wound under tension in this machine. The result: a wound core with no air gaps; practically ideal core shape.



Core is not cut or unwound after annealing: assures stable characteristics; freedom from stresses; lower leakage flux; better ratio of losses.

Geared split flanges are placed around the taped core legs, which act as a shaft upon which winding machine revolves flanges (which are removed later).



Coils are wound on paper tube winding form which insulates coil from core. Even tension prevents air spaces, decreases resistance, lowers reactance.

LM

LINE MATERIAL

TRANSFORMERS

L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers • Fuse Cutouts and Fuse Links • Lightning Arresters Oil Switches • Pole Line Hardware • Line Construction Specialties • Underground Equipment • Fibre Conduit • Street Lighting Equipment

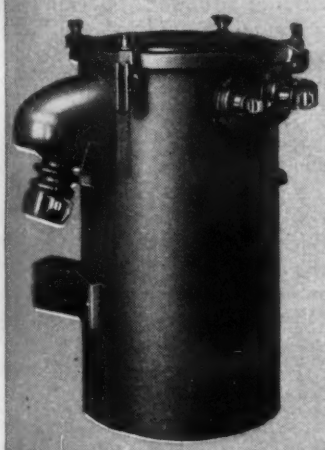
man should know Transformers

How they perform

- **INCREASED REVENUE . . .**
  Because they give improved regulation at all power factors, L-M Round-Wound transformers deliver increased voltage to your customer. Thus they increase your operating revenue, and also your rate of profit per kilowatt-hour.

- **LOWER COSTS . . .**
  Because they have a better loss ratio—lower copper loss in relation to core loss—L-M Round-Wound transformers operate more economically. Improved time-temperature characteristics and higher short time overload capacity give longer transformer life, lower replacement cost. Uniformly high impulse strength decreases the chances of failure caused by lightning, another reason for lower operating cost.

- **BETTER CUSTOMER RELATIONS . . .**
  Better regulation means fewer low-voltage complaints from customers. Lower reactance cuts flicker, reduces complaints. Fewer failures caused by lightning and overloads mean fewer service interruptions. These help improve your relations with your customers.



Meet latest EEI and NEMA standards. L-M Round-Wound transformers are built in complete accordance with EEI-NEMA standards. Hangers, bushings, terminals and accessories are regular NEMA standard specifications.

Ratings. L-M Round-Wound transformers are available in 1½ to 25 Kva, 2400 to 7620 volts.

Other types. Line Material offers many types of transformers: single and three-phase, "3-I" (protected), dry type, subway, rural, and conventional type distribution transformers up to 500 Kva. For information write for bulletins on the type you require.

It will pay you to investigate the characteristics of Round-Wound construction. The ideal core shape without air gaps; and long, evenly wound coils with no air spaces between layers permit fewer turns in coils without sacrificing low exciting current.

The round coils, with generous, undisturbed insulation and exceptional cooling, aid in assuring uniformly high impulse strength, greater protection against lightning hazards, and greater capacity for short-time overloads.

These are some of the reasons why it will pay to standardize on L-M Round-Wound distribution transformers, now, and for your new construction.

Here is Why:

1. Improved regulation at all power factors.
2. Better ratio of losses.
3. Uniformly low exciting current.
4. Uniformly high impulse strength.
5. Higher short-time overload capacity.

GET THIS FREE BULLETIN

Ask the L-M Field Engineer for a copy of Bulletin RW-421 which gives a good deal of information on Round-Wound design and construction, and features such as tanks, bushings, tap changers, hangers, and mountings and accessories, lists ratings of L-M transformers available. Call or write the nearest L-M branch for a copy, or write Line Material Co., Transformer Division, Zanesville, Ohio.

LINE MATERIAL
TRANSFORMERS

L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers · Fuse Cutouts and Fuse Links · Lightning Arresters
Oil Switches · Pole Line Hardware · Line Construction Specialties · Underground Equipment · Fibre Conduit · Street Lighting Equipment

ELECTRA'S HUSBAND

Don't Fence Me In

"KICKING the traces" is a good old expression that derives from the horse and buggy days. Seems as if "Don't fence me in" will live a long time too, because it expresses something fundamental in human yearning. It isn't only when Electra gets fed up with staying home and wants to go out to a show, when I'd rather just enjoy some peaceful quiet after a whole day out. That may have brought the subject to mind, but it goes deeper than that.

"Don't fence me in" expresses the whole idea of freedom. It is the essence of enterprise. It fights regimentation. It is the cry that raises man above the beasts which *he* fences in. And it is proud we should be that a man in the electrical industry gave us that expression, even if credit for it now goes to another.

Well known for his Western writings, R. H. Fletcher is recognized in the electrical industry as Bob Fletcher, advertising and publicity man for Montana Power Co., and makes his office in Butte. But like other Montanans, notably Charles Russell, the cowboy artist, Bob Fletcher has a flare for Western lore. He has written stories, poems and songs.

So in the fall of 1935, when Lou Brock, a producer for Fox, was working on a movie script called, *Adios Argentina*, he signed up Cole Porter, the famous songsmith, to write six musical numbers for the show. One of them had to be a Western of a certain type. Porter couldn't write it. Brock asked Fletcher to suggest a title and do the song.

Bob Fletcher suggested the title, *Don't Fence Me In*, and wrote the original lyrics and a melody. Cole Porter then bought the title and lyrics from Bob Fletcher for $250, and wrote another melody and adapted Fletcher's lyrics to it. The result is that song which you have heard recently. The show, *Adios Argentina* was never filmed. The song was never released until Warner Brothers acquired it from Fox and used it in the picture, *Hollywood Canteen*.

Instead of getting the recognition which had been promised when the song was sold, recently when it was disclosed how the song came to be written, Porter is said to have denied Bob Fletcher's authorship and several columnist cronies pooh poohed the idea that Fletcher had contributed much to it, saying that Porter had completely rewritten it.

That sort of cattle rustling up in Montana would invite a posse, but the Hollywood brand of mavericks rustle all the glory they can get away with for themselves. In order that they may not get away with this thoroughbred of Bob Fletcher's, here is the way Bob Fletcher wrote it. Compare it with the words as they now appear in the Cole Porter song.

There are a few more words to the Porter version, some repetition of a line or so to fit the music, but the best lines in it are here in those Fletcher originally wrote. That isn't completely rewriting it, as the Winchells and the other pals of Porter claimed, it is just altering the brand with a new branding iron—the old shows through it.

Don't fence me in
Give me land, lots of land
Stretching miles across the west
Don't fence me in
Let me ride where it's wide
For somehow I like it best.
I want to see the stars, I want to feel the breeze
I want to smell the sage and hear those cottonwood trees.
Just turn me loose
Let me straddle my old saddle
Where the Rocky Mountains rise,
On my cayuse
I'll go siftin', I'll go driftin'
Underneath those western skies,
I've got to get where the West commences,
I can't stand hobbles, I can't stand fences
Don't fence me in.

Whether, as Bob Fletcher says, the song has gone the way of all temporary public favorites or not, the title, *Don't Fence Me In*, is very likely to be of the stuff that never dies. It is too expressive of a feeling that man will always have in his heart. It is as American as the plains and the Rockies. It is the theme of enterprise—

Don't Fence Me In!

"WHAT are you laughing about?" Electra asked one evening recently as I sat in the living room going over a lot of booklets and bulletins that had accumulated on my desk at the office and which I had not had time to read.

"A piece here about reconverting salesmen," I said. "It never occurred to me that salesmen will have to change, along with everybody else, from war to peace. This chap is writing about salesmen's clothes. He claims that a lot of modification will have to be made to offset wartime changes."

"That's silly," Electra said. "There haven't been any changes."

"That's what this fellow's boss thought until he explained what he meant. For instance he tells about the heavy reinforcing in the seat of salesmen's pants. 'Most salesmen have been sitting around so much accepting orders people keep shoving at them that ordinary pants wouldn't stand the gaff,' he says. When they really have to go back to chasing business he thinks that the reinforcing will cut down their speed unless it is removed. 'A major overhaul job' he calls it, like putting in knee pads."

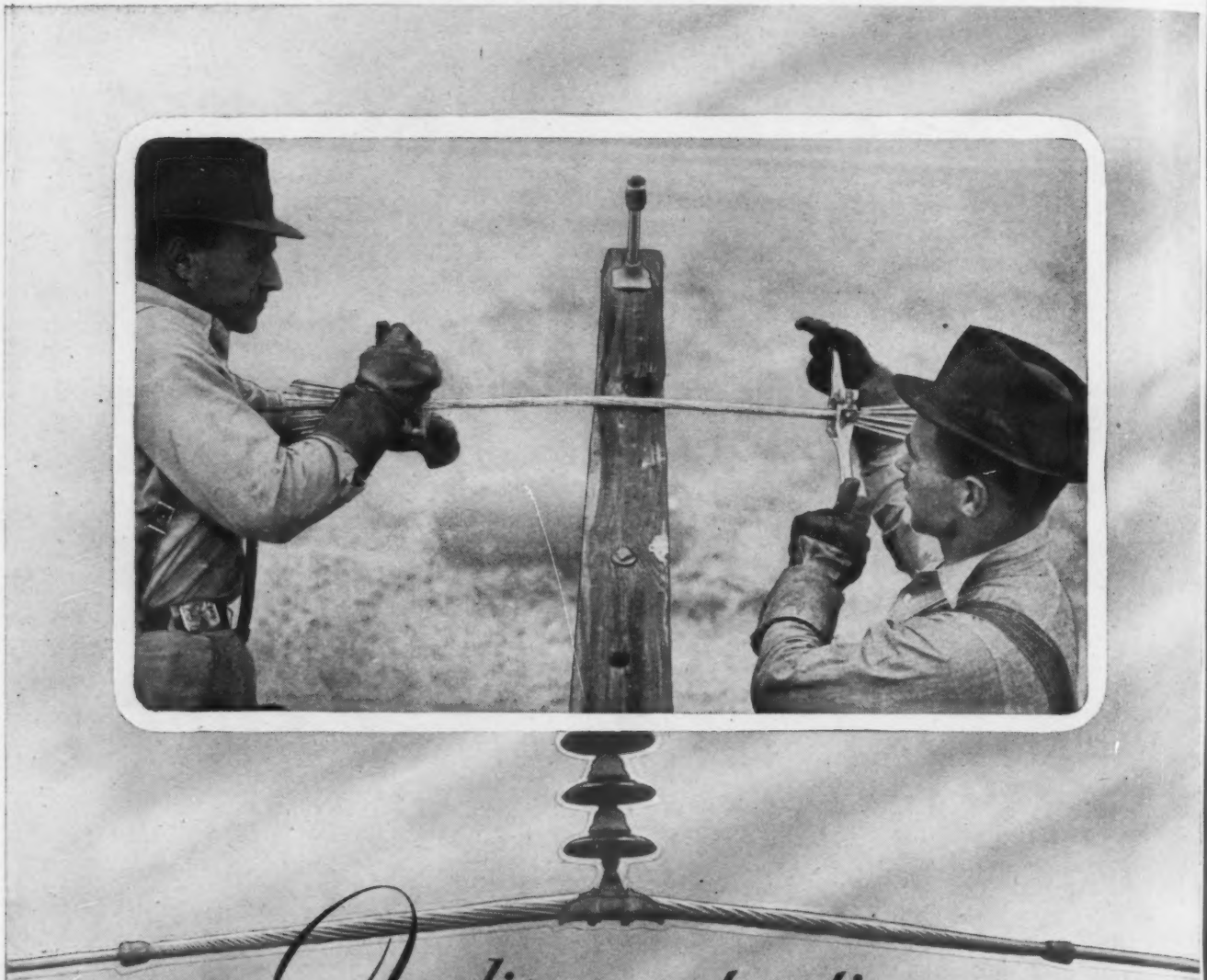
"Why knee pads?" Electra asked.

"He says no more orders are going to be handed out on silver platters," I answered. "Do I have to remind you of the selling job I had to do on you to get 'yes' for an answer? The final change, he says, that will have to be made is in hats. They must be rebuilt so as to take the size down two or three notches. He thinks salesmen have been on the receiving end of so much easy business that their heads are swelled. Upshot of the situation, he claims, is that all salesmen are going to be forced to relearn such fundamentals as trying to please the customer, how to revalue customers' needs and the real meaning of service."

"Heaven speed that day," Electra commented. "There are just thousands of women who are going to welcome real salesmen joyfully. Even in the best stores the so-called salespeople have forgotten all of the fundamentals of selling. Just the other day I went into Blank's to see if they had any shorts for you. Do you know what the clerk said? 'Go look in that showcase.' A lot of master minding is being done about quantities of this and that which housewives are going to *buy* after the war. What a surprise some sales research experts are going to get when goods are available once more. Today's pent up demands are 'demands' simply because we can't get things. Just wait and see how demand is going to cool off. It's going to take salesmen to sell us—real salesmen."

Don't the master minds know that the gals like to do a lot of *shopping*?

you can't put the squeeze
on SEALDTITE
CAPACITORS
SOLAR
SEALDTITE



Quality construction ~

IN EVIDENCE AT EVERY POLE TOP

Armor rods prove to men familiar with line construction that here's a line which has been carefully and wisely engineered; no skimping on first costs, to be paid for later because of higher operating costs.

Alcoa Aluminum armor rods reinforce conductors at points of support, preventing vibration failures. Armor rods also prevent chafing, take the brunt of flashovers at insulators, and are invaluable for repairing lines where such damage already has occurred.

For help on engineering your lines—design, stringing, or maintenance—consult Alcoa, makers of Alcoa A.C.S.R. and line fittings. ALUMINUM COMPANY OF AMERICA, 2132 Gulf Building, Pittsburgh 19, Pa.

ALCOA

ALCOA A-C-S-R

ALUMINUM CABLE STEEL REINFORCED

ELECTRICAL WEST

VOL. 95 NO. 2
AUGUST, 1945

BIG STRIKES FROM SMALL GRIPES GROW

*O. R. Hartwig**
Industrial Relations
Crown-Zellerbach Corp.
Portland

IT has never been completely and satisfactorily determined whether the conflict that occurred in heaven, according to the Bible, when the ranking angel and others rebelled and caused God All Mighty so much trouble, was a sit down strike or lockout as we understand these two practices today. Probably both.

In any event, it appears that God told the agitators to go to hell, which according to the same authority they promptly proceeded to do. The effect of that break in satisfactory management and personnel relationship has been far reaching. It has extended down through the ages and is everywhere evident today. Of course, this happened long before we moderns had developed systems of sound industrial relations and constructive personnel methods as the result of our studies of mere humans.

Sometimes I question the possibility of ever finally solving our human relations problems feeling that it is the height of presumptuousness to assume that we can succeed in settling problems of this nature when the Master of us all had difficulty doing so not with humans but with angels.

I have often pondered as to just what in heaven those angels could have been complaining about, unless it was a perpetual shortage of manpower and the consequent necessity for long hours each day for them, with no or few holidays and annual vacations.

Biblical history does not record—at least I don't remember that it does—that there has been any trouble so far as personnel is concerned in hell since the Devil and his cohorts set up business there. Therefore I am inclined to believe that either his satanic majesty has ruled his domain with an iron hand, ruthlessly subduing those who complained, or else the answer may be found in the fact that they have always had an ample supply of labor on hand, on whom they could turn the heat to make them work, so that top management and members of its staff have plenty of leisure time during which they can amuse themselves in various ways and thus remain reasonably contented with their lot in hell.

Our Problems on Earth

Excepting during periods of war such as we are in today, industry usually has an ample supply of workers. The unions by their demands have largely solved the problems of holidays and vacations with pay, as well as providing the incentive for instituting many other changes in working conditions calculated to make workers happy on and with their jobs. And yet, we are continually faced with new and seemingly more difficult employer-employee relations problems. These need to be studied and ironed out if we are to have satisfactory results in building a better world for future generations. Endless volumes of advice have been written on the subject of sound human relations. Much of this advice is good; some of it is pure rubbish or theory.

In the field of engineering or in the sciences definite information can be and has been recorded concerning the nature of either the materials or elements employed to accomplish results. The same is largely true in the field of mechanics. This is more or less true of practically all phases of life excepting the one of human relations.

Humans are said to be the acme of accomplishment and development in the progress that has been going on now for centuries. This is especially true concerning that part of the human being, the head, which serves as the location or residence of the brain and all but one of our five senses. But unlike many animals and other forms of life of which the same thing can be said, humans are supposed to control their actions by the intelligent use of their brains instead of responding as animals do to instinct.

Apparently, however, our Creator decided to endow humans with certain characteristics similar to those possessed by most, if not all, animals. Among these are the biological urge to reproduce, another is self preservation, calling for food as well as protection against the elements and either animals or humans who would destroy or harm us or those whom we consider near and dear to us.

In addition to the two basic urges just mentioned and others, all humans are endowed with what has been named "ego." Some humans are very egotistical, others less so.

Now it should be remembered that under the broad term of "ego" are included many items, such as vanity, conceit, etc. Sound reasoning, based upon logic, serves as a *brake* upon the various manifestations of the ego in us. Not too many of us humans, however, enjoy putting on the brakes to our ego any more than we do when we are driving the family car. We usually do so only when self preservation takes over the reins of the mind and dictates what we should do under the circumstances present for the moment.

Generally speaking, humans to a large extent do employ their brains to solve their individual and collective problems but too few have had training of any kind designed to show them the value of doing so, plus how it can be done effectively. It is my opinion that there is no shortage in thinking so far as quantity is concerned, but that there is definitely a shortage of *quality* thinking or reasoning. Nor is it strange that this be true.

Most of our minor educational institutions still feature the three "R's" with some additions, such as history and geography. Just what brought on the gyrations in historical recordings or what caused the geography of the

* Presented to Administrative Services Section, Pacific Coast Electrical Assn., June 28, San Francisco.

world to change as the result of wars and consequent conquest of areas by this or that nation or group of people, is rarely ever taught. As a matter of fact, most of our teachers are probably unequipped by training to teach such fundamental truths.

Likewise the art or process of sound or logical thinking, in which the known and obvious effects are traced back to the cause which started the chain of events on its way, is rarely ever taught even in our higher institutions of learning, excepting perhaps as special post graduate courses. Small wonder then that most of us do a lot of loose or unorganized thinking as we wander onto and across the stage as actors in life's great drama.

The basically savage or animal nature with which each of us is endowed when we are born, unless modified by education, environment, religion or laws, continually causes us to do things which are contrary to civilized concepts of right or wrong. Even when we have been exposed to the refining influence of society's machinery for conditioning us to be acceptable units in its ranks, many of us still recognize the force at work within us urging us to revert to savage or primitive practices to get what we want for ourselves.

I want to refer to this tendency to revert to primitiveness just sufficiently to bring out the thought that *most human beings respond rapidly either favorably or unfavorably to treatment depending upon whether their primitive natures have been violated or nurtured.*

Education alone will not prevent a human from responding adversely; it may serve to cause him or her to conceal his resentment, but it will not prevent the rise of resentment from the innermost depths of his being if whatever is said or done to him runs counter to what he feels is right.

His fear of becoming involved in a law violation may cause him to control and finally dismiss the idea to flare up or show resentment in a violent way. His fear of losing his job during periods of job scarcity might do the same thing, but the chances are that he will continue to resent what has happened to him and show his resentment by lack of wholehearted effort to do his job as he should and would if his feelings had not been hurt.

Despite the fact that it is difficult to set up exact methods for assuring results in dealing with labor, because of the many variables and vagaries humans are governed by, the task is not exactly a hopeless one. We see evidence of reasonably successful results in human relations everywhere about us in industry and out of it. It is not too difficult for most of us, including employers, to recognize the gradual, but nevertheless steady, trend toward liberalization in industry in dealing with our fellow humans.

Too many of us, however, in industry, are still too prone to think of *our* so-called rights; and ignore the rights of *others*. In other words, when our primitive nature is in the saddle, we are inclined to know only one rule and that is to take what *we* want regardless of what others' interest or right may be in the same object or purpose we are after. For centuries now the struggle has been going on and history's pages are replete with instances of might being made right. Yet gradually but surely human rights are beginning to emerge to take their proper place in the scheme of things.

Obviously, if we take into full consideration the rights of our fellow man, or in other words, ask ourselves the question when we covet something, be it some object, money or profit, "just what portion of this am I properly entitled to in the light of a proportional right on the part of my fellow man," then we are not so apt to overstep the bounds of equity. We are inclined to do so and usually do so when we ignore other people's rights.

In setting up basic standards of sound human relations in industry, therefore, we should be sure to have real equity as our keystone, otherwise we are bound to go off on a tangent which may lead us to unending complications in dealing with our employees or with others with whom we are thrown in contact.

Big trees from little acorns grow. Big labor disputes grow from little complaints that have not been cleared up immediately.

By ignoring or postponing consideration of minor complaints, we are in substance tossing them into the scrap bin, and as is common with scrap material, we forget about it.

But remember, the individual who made the complaint does not forget about it.

Quite often if something is not done about the complaint he raised, either by correcting the condition if the complaint was justified, or by pointing out to him or her that a correction can not be made at the time but will be made when opportunity offers, we are inviting trouble for ourselves.

If there is no real basis for the employee's contention we should fully explain the absence of a real foundation for his or her complaint. Otherwise whoever's duty it was or should have been to arrest the growth of the *feeling* being generated with respect to that particular complaint, is piling up grief either for himself or for his firm.

Many serious work stoppages have taken place as the result of an accumulation of complaints from even a limited number of employees because their complaints were ignored and their feelings were hurt. Their ego was punctured and they were stimulated to "get even," as such persons often express it. Once *feeling* creeps in, reason begins to subside and finally may take leave completely; then the ego goes on the warpath and, responding to strongly rooted animal natures, such workers resort to any device available to avenge the damage they feel was done to their ego.

One way individual workers have of doing so is to convince their fellow workers that they too will suffer along the same lines sooner or later. They magnify every little thing that they can think of to mountain-sized proportions, frequently resorting even to untruths to attract attention and sympathy for their position. In other words, they will justify their action by tearing down, if necessary, any good or satisfactory relations which may exist between employees and employers in the plant or office where they may be working.

Forest fire fighters have long ago learned that it is highly important to put out fires when they are still small. The same logic applies in industry with respect to complaints from workers.

Frequently, labor disputes which are publicized as having for their basis unreasonable demands for wage increases can easily be traced to other causes not even remotely related to a general spontaneous demand for higher wages. These charges wound up that way because some isolated unfairness had not been attended to by management.

Now, I can just imagine someone saying something like this: "All you've told us sounds pretty good, but for the love-of-Pete don't you realize that ordinary business men are not psychologists, and further, that to follow a plan of employee relationship such as you are talking about would require much time and attention?"

My answer to such a statement would be, "Certainly, I know businessmen as a general rule are not psychologists. I also know that it costs money to follow such a practice," but I would also add that in the first place one does not have to be a psychologist to apply sound fundamentals of human relations.

One needs only to use common sense —apply the principles of the "Golden Rule," i.e., "Do unto others as you would have them do unto you." In other words, ask yourself the question: "How would I like to be treated if I were the other man or woman in the case? Suppose he was the boss and I was the workman?"

The answer is at once obvious, since you would want to be treated considerately, would you not? Then, follow that practice when dealing with em-

A Clue to Leadership—How Soldiers Rate Their Officers

TO find out what its enlisted personnel thinks about a number of things important to morale and performance, the Army recently interviewed at length some thousands of soldiers. What these soldiers said, according to *Infantry Journal*, makes it clear that human relations are much more important to morale than beefsteak, warm socks, ball games, and vaudeville shows, or what the men believe about the war. The men mentioned 77 features of Army life as definitely associated with morale and, of the 20 most closely related to morale, 16 have to do with man-officer relations. Condensed from *Infantry Journal*, are some of the points brought out, in order of their association with good leadership in the minds of enlisted men.

1. Ability. The good officer must know his stuff, for on this depends the men's confidence in his leadership.
2. Interest in the welfare of the soldier.
3. Promptness in making decisions.
4. Good teacher or instructor. The leader who has the patience and ability to make things clear to the men under him is valued for that reason.
5. Judgment, common sense and the ability to get things done.
6. The good leader does not "boss you around when there is no good reason for it." Soldiers dislike an officer who throws his rank around, who tests his own authority continually. They sense that he is not sure of himself.
7. "The man who tells you when you have done a good job" rates well as a leader. Failure in commendation is a common complaint in the ranks. Best incentive to good work is prospect that it will be noticed.
8. Physical strength and good build.
9. Good education, sense of humor and "guts" or courage.
10. Impartiality. The good leader is fair to all his command.
11. Industry. Leaders who "do as little work as they can get away with" are not respected.
12. When an officer "gives orders in such a way that you know clearly what to do," that too is a mark of merit as a leader. Soldiers also like an officer with a "clear strong voice."

ployees. Simply learn how to apply the Golden Rule and then determine to practice it.

Lay aside as much as you can the primitive urges which are driving *you* on and assert themselves in *your* nature. You, the employer, should be the best informed with respect to such matters and therefore should know how best to minimize the primitive urges in others so that they will be stimulated to respond to them as infrequently as possible.

However, we must never assume that the decent and fair thing we do today will suffice to cause our fellow human being, be he either someone for whose supervision we are responsible or not, to be satisfied for all time to come. Sound human relations is a *continuous* job—it must be a regular practice, a common habit, an always automatically functioning sound behaviour pattern. Otherwise, it falls far short of accomplishing the maximum results that are possible.

Experience has shown that reasonable results in satisfactory industrial relations can be expected and will follow if reasonably sound practices are employed.

The censuring of an employee should never be done publicly if it is your intention to continue employing him. It is not warranted even if you harbor the hope that he might be induced to quit as the result of the public rebuke you are administering or plan to administer. If he happens to be the type who has not responded to private corrective suggestions, then it is much better to call him aside and tell him you have decided to discharge him and tell him why you are doing so without others being present.

If you happen to have a contract with some union which represents him as collective bargaining agent and he has ignored private attempts to correct his wrong attitude, then it might be desirable to advise the shop steward, or other type of union representative, concerning his misbehaviour and suggest that the union officer attempt to induce him to do what is right. If that fails to get results, discharge him quietly.

If it is necessary to discipline an employee and it has been done without publicity, then it will prove helpful in getting satisfactory results if the employer closes the interview with an expression indicating that he does not harbor any malice or vengeance. That, instead, he is convinced that the little chat they have had will prevent any repetition of the offence which made the conference necessary. Generally speaking this will serve to help rebuild his ruptured ego. He will appreciate it. The rebuke, if properly administered, will arrest future misbehaviour in most instances.

From my remarks thus far, you may conceivably gather the impression that I favor or advocate coddling people and that I urge the adoption of practices with respect to employees in which there is no place for sound disciplinary techniques. If by chance some have gained that impression, let me hasten to correct it.

Intelligently applied discipline is quite essential to sound business management. Remember what I said earlier concerning our primitive natures and the tendency to demand things to which in true equity we are not properly entitled. There is nothing in our basic animal nature which causes us to want to do our proper share of the work, for instance.

This attribute is a product either of our education or parental guidance or influence, or if it is not the result of cultural influence, then it might be induced to express itself as the result of fear of loss of a satisfactory job, as expressed earlier. *When* and particularly *how* to discipline a worker is the important thing to give serious thought to.

Most people, even when they recognize they are at fault, deeply resent being "bawled out" publicly. They instinctively know that public bawling out will tend to belittle them in the eyes or minds of their fellow workers. It will serve to deflate their ego, and that in turn causes their anger to rise and reasoning to depart, etc.

Let me suggest that sound *employee* relations represents the reinforced concrete foundation upon which a substantial and long-lasting good *public* relations program can be built. Without it, the public relations structure will probably be an architectural monstrosity, subject to destruction or at least damage whenever some selfish interest decides to attack it for any reason or no reason at all. Sound accident prevention techniques applied to industrial plants and in traffic as well as in the home have brought rich rewards. It will do the same in the field of human relations.

Pre-formed Armor Rod Protection

Armor rods pre-formed of various metals to fit any size conductor are offered as solution to vibration and other troubles at point of insulator support

*T. F. Peterson**
American Steel & Wire Co.

OVERHEAD lines for transmission of power and communication have been in such general use over so many years as to become almost commonplace. It does not follow, however, that their electrical and mechanical development and improvement have been relegated to an infrequently observed background. On the contrary many committees and individuals have continually studied the more theoretical and technical phases of transmission line performance.

Although line insulation research and development has progressed at a fairly steady pace over the years, conductor support has been the subject of but sporadic attention and study. The infrequent attention to conductor support problems may be attributed in part to a lack of compilations of statistical data on line performance which, had they been available, would certainly have long since pointed to the importance of this part of a transmission line.

The ultimate life of overhead conductor installations is influenced by many factors, and indeed, failures may be ascribed to numerous causes. Some of the devices listed below meet one or more of the service requirements in something like the manner and frequency with which these conditions occur:

a. Conductor wrapping with strip metal.

b. Use of shims and seating material in suspension clamps.

c. Wire wrappings over conductors to produce so-called "armor ties."

d. Trunnion type suspension clamps and post insulator type clamps.

e. Armor rods, both tapered and uniform diameter.

f. Dampers such as the "Stockbridge" resiliently suspended weight and torsional type rigidly mounted to the conductor.

Much current thinking and engineering seem to be predicated on rather lopsided ideas as to the relative importance of one or another element contributing to failure. For example, from the emphasis in current advertising and engineering placed on "corrosion," one would conclude that this contributes in an important way to determining ultimate life of line. Unfortunately, without statistical data, it is difficult to correct such views. However, accumulating evidence on line performance shows frequent failures due to such causes as:

a. Wear—tie wire burning and chafing of conductor or tie wire.

b. Vibration fatigue of conductor or ties.

c. Arcing from conductor to ground.

d. Pitting of conductor inside clamps due to arcs striking clamps and passing to conductor.

e. Conductor burns at points of lightning strikes.

f. Tensile breaks during storm loading at points of conductor weakness due to any of the above.

The ideal method of suspension would not only reduce or eliminate these sources of trouble, but would meet other operating requirements with maximum assurance of easy reproductibility of results under all types of installation conditions. Quite obviously it must be justified economically and must lend itself to installation by linemen of varying skill.

Pre-formed Armor Rods

Pre-formed armor rods and the recommended multiple wire ties described herein meet the stated requirements. In practice, round or shaped wires or strips are pre-formed into open helices having uniform pitch length approximately twelve to fourteen times the diameter of the conductor and having an inside diameter slightly less than the outside diameter of the conductor to insure a snug fit. Such rods are shown in Fig. 1. An individual preformed armor rod is held against the conductor and then with a simple rotation of the ends is applied to cover a portion of the conductor as shown in Fig. 2. By proper choice of the number of rods, pitch angle, and the like a complete covering may be developed over the conductor. The rods may be staggered along the length of the line to provide graded flexibility at the suspension clamps, dead-ends, or insulator ties. No clips are used to hold the rods on the conductor. Galvanized spring steel, aluminum alloy, hard drawn copper, and bronze have been used in the production of these reinforcements. Although the most general application is at insulators and dead-end clamps, the reinforcements may be applied at mid-sections for effecting line repairs.

Almost any conventional methods of clamping or tieing may be combined with this system of conductor reinforcement. However, extended testing of some special multiple wire ties indicates that these are extremely effective and relatively inexpensive and easy to install. Techniques have been worked out which allow application and removal of these ties with hot-line equipment. The details are hardly within the scope of this discussion, but the photograph of Fig. 3 should indicate the ultimate possibilities along these lines.

Pre-formed Armor Advantages

Arc-over of insulators from conductor to ground frequently contributes to line failure, since wires may be burned off or annealed. The pre-formed armor rods completely covering the conductor preclude this, and since they are under no tensile load, cannot contribute to line failure even when severely burned.

Pitting of conductor strands presumably due to power currents attending flashover to suspension clamps, thence to line conductor, is avoided since extended and intimate contact is made between the conductor and armor rods, and in turn the armor rods make very good contact with suspension clamps.

Corrosion of conductors at supports is practically avoided by virtue of the complete covering and elimination of the action of weathering, electrolysis, and the like at the very points where ordinarily lines are quite vulnerable.

Abrasion and chafing at supports, coupled with accompanying corrosion, are precluded. There is practically no relative motion between conductor and

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* Based on a paper presented before recent meetings of Operating Economics Section, PCEA at Los Angeles and San Francisco. Author is manager, electric sales division, American Steel & Wire Co., Cleveland.

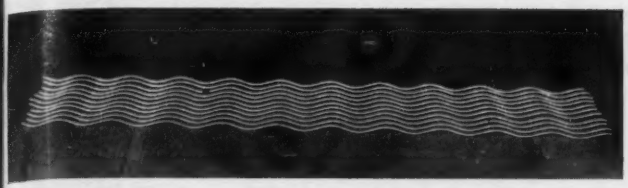


Fig. 1 (left)—Complete component set for PFT armor tie

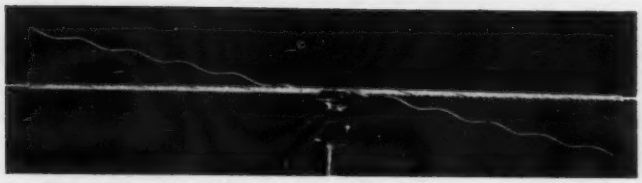


Fig. 2 (right)—One armor reinforcement partially removed

the ends of the reinforcements, and no more relative motion over the entire length than would occur between two layers of concentric strand. The line conductor is, therefore, protected in much the same way as the inner layer of a 19- or 37-wire strand, and the more vulnerable conductor elements are kept out of contact with clamps or ties. Such abrasion and chafing as may occur on the armor rods is of negligible importance in view of their mass, physical proportions, and durability.

Holding power of the recommended ties, in conjunction with reinforcements, is unbelievably high as evidenced by the tests depicted in some of the accompanying photographs. (See Fig. 4.) The reinforcements grip the conductor so tightly as to bridge broken wires and maintain a high percentage of conductor strength. (See Fig. 5.) Ties and clamps have greater gripping area over reinforcements than would normally be provided over the uncovered conductor.

Installation may be made even by the inexperienced in a short time and without special tools. Precision fabrication insures identical application in the field without dependence on training or skill of linemen. Rather simple techniques have been developed to allow live line application of reinforcements.

Taps and hotline clamps may be applied directly to the reinforced conductors with minimum danger of reducing the vibration life of line and without danger of conductor corrosion at clamp contacts weakening the line. The large diameter over reinforcements makes for large contact area at taps, hence low contact resistance.

Vibration and damping characteristics are superior to those of many conventional supporting ties and clamps.

Although we do not have sufficient field data to enable us to extrapolate results of laboratory tests, we feel that they are indicative of the unusual performance that can be expected in service.

Laboratory Tests

While vibration alone of an overhead conductor sometimes produces dynamic stressing of sufficient magnitude to cause failure, it is a rare case where vibration exists devoid of the multiple effects of stress concentrators.

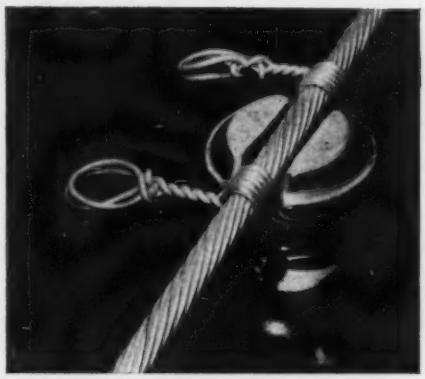


Fig. 3—Application of two-piece hotline tie to PFT armor reinforcement

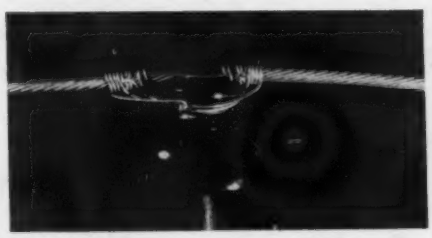


Fig. 4—Effect of unbalanced line tension on PFT armor with three-piece tie

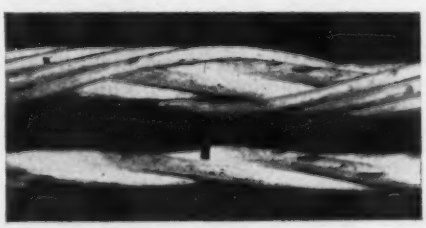
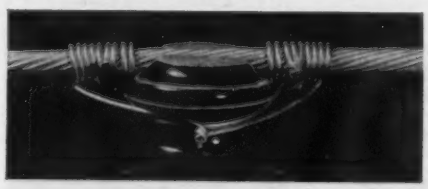


Fig. 5—Specimen (above) of No. 6 Amerductor failure in fatigue and under tension with several armor components removed to illustrate the axial load capacity of armor. (Below) Same specimen with all armor removed showing separation at failure point

Fig. 6—Completed PFT armor type tie



Among the greatest offenders are the conductor stress raisers, or concentrators caused by:

a. Poorly designed supporting means.

b. Abraded conductor cross-sections.

c. Application of mass concentrations to conductor, such as hotline clamps, splices, etc.

d. Wire surfaces damaged by electrical or chemical action.

In order to evaluate the relative benefits of suggested designs and methods of conductor construction on the basis of vibration, a specialized type of testing equipment has been employed. Vibration amplitude can be controlled very closely and made to remain constant throughout a particular test. Amplitude measurements are made by means of a cathetometer, calibrated in one-thousandths of an inch. When failure occurs anywhere in the vibrating system, the frequency or amplitude will diminish, actuating a sensitive shut-off circuit. The total number of cycles for each test is calculated from the readings of a time clock which is an integral part of the equipment. As an aid to observing various modes of vibration, and the action between component parts, a portable stroboscopic light is employed.

Multiple Wire Ties

The multiple wire tie developed through extensive use of this vibration testing equipment is shown in Fig. 6. The tie shown was a development resulting from a large number of individual vibration fatigue tests made on simple ties in common usage as well as the more complex and less popular ties, during which the merits and faults of each were studied carefully. To overcome the effects of direct contact of a tie with the conductor, it became evident that complete conductor coverage should be employed. This requirement was met by the use of preformed armor.

Another common fault among popular ties is their inability to maintain tight contact between the tie wires and the armor or conductor. This fault was remedied by eliminating the common long helical wraps, and substituting a twisting of the ends of the tie wires around the armor. A further fault contributing to a great deal of conductor abrasion against the insulator groove is the inability of most ties to hold the conductor tightly against the groove, a shortcoming which was remedied by the use of the final twist of tie wire ends around the insulator

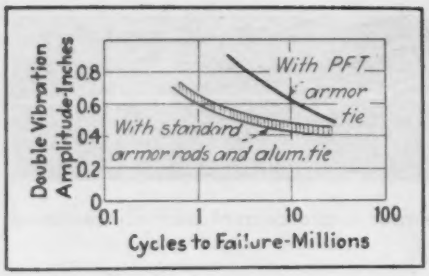


Fig. 7—Vibration fatigue curves for conductor with and without armor tie

neck, very effectively drawing a conductor tightly against the groove. Such a tie combination, because of the preformed armor, has very low stress gradients. In addition, the benefit of gradual stress relief by the employment of four points of tie support on either side of the insulator is apparent. In order to visualize some of the overall benefits obtainable through the use of such a tieing system, we should first observe the fatigue data.

Vibration Fatigue

A graph is shown in Fig. 7 on which are plotted the number of vibration cycles for conductor failure vs. amplitude of vibration of No. 4 A.C.S.R., as obtained on the test equipment previously mentioned. Some obvious merits of the tieing system just referred to are clearly shown by comparing the life of the same conductor at any given vibration amplitude, first using the common armor rods, and secondly the PFT armor tie. Interpreted in terms of line vibration in the field, this means that the improved tieing system should enable a conductor to yield longer service life at any given vibration amplitude, more especially at severe amplitudes. For instance, at an amplitude of 0.6 in. we might expect approximately one million cycles for conductor failure using the standard aluminum tie, whereas tests indicate a life of ten million cycles for the PFT armor tie.

Other types of conductors have also been studied. Fig. 8 shows the improvement of fatigue life obtained where an improvement over the ordinary simple copper tie was sought. One curve plots a conductor life using the ordinary copper tie on a No. 6 copper, copper covered steel; the other is a plot of the conductor life for No. 6 Type SCG Amerductor using a PFT armor tie. The latter combination in this case produces an almost infinitely

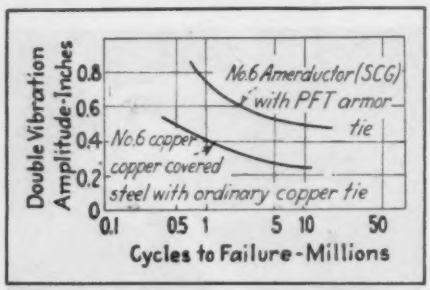


Fig. 8—Vibration fatigue curves for No. 6 Amerductor with armor tie and copper covered steel with ordinary tie

longer fatigue life, especially at the higher amplitude values. This is partially because of the inherently high fatigue vulnerability of copper clad conductors.

Another test showed the end loop and adjacent loop of a conductor under vibration at 80 c.p.s., illustrating how the vibration amplitude is effected by the application of the armor tie. The stresses at critical points, such as at insulators, increases as the amplitude of vibration at that point increases. Therefore, we might expect that where a tie system tends to reduce the amplitude at a critical point, the result would be consequent increase in conductor fatigue life. This trend can be shown more clearly by observing a plot of amplitude vs. distance from the insulator for at least two loops.

A graph is shown in Fig. 9 on which such data are plotted. It will be observed that the vibration amplitude of a conductor having no armor or no tie of any kind is essentially constant from loop to loop, and, that by adding only a simple tie to the conductor, a barely perceptible amount of decrease in amplitude occurs at the insulator loop. Similar data plotted for the aluminum armor rod and tie construction indicate a considerable decrease in amplitude for the first loop, while the data obtained from the PFT armor indicate a further reduction in amplitude for the critical loop. It should be stated that the data reported in this paper

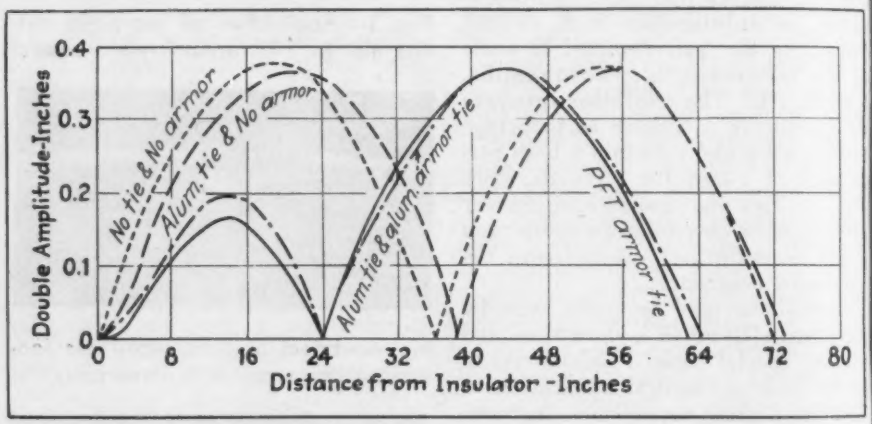


Fig. 9—Graph showing plot of amplitude of vibration vs. distance from insulator for the various combinations

were for conditions of constant amplitude at the second loop, which means that more energy was required in the cases where high damping was present.

Damping Tests

Another type of test used to evaluate a tieing system is the test for damping capacity, or rate of decay of vibration. The same vibration equipment previously referred to was used, in conjunction with suitable control devices and an oscillograph for recording the curves. Shown in Fig. 10 are typical decay curves obtained. The bottom curve shows a decay characteristic of the conductor contacting the insulators, but with no reinforcing or tie, of any kind. The decay characteristic in this case includes all of the inherent mechanical as well as electrical damping of the vibrating system. This curve

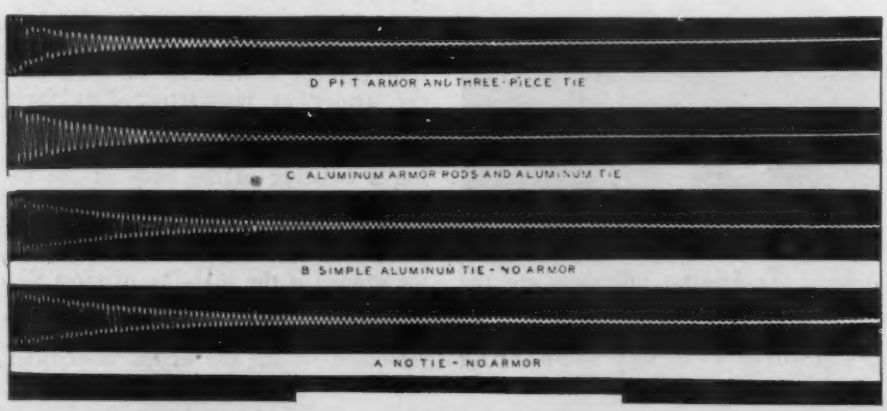


Fig. 10—Decay curves, No. 4 A.C.S.R.

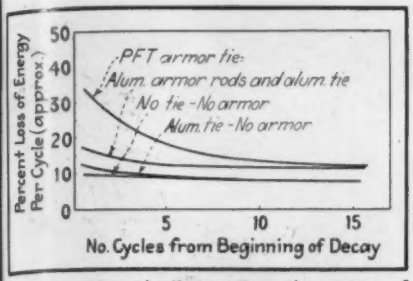


Fig. 11—Graph illustrating the rates of energy dissipation for the decay curves of Fig. 10, by showing relative values of damping capacity for each test

may be considered as a basis of comparison for the subsequent curves.

The second curve from the bottom shows the effect of the use of a simple aluminum tie without the aid of any reinforcement. It will be noted that there is very little difference in decay characteristic between this and the former curve, indicating that this tie alone has very little to do with the damping characteristic.

The third curve up shows the decay characteristics of the same conductor, having applied to it a conventional set of aluminum armor rods and tied with an aluminum tie. The rate of energy dissipation in this case is considerably greater than that of the two preceding curves. Finally, the top most curve represents the decay characteristics of the PFT armor, and it can be observed that the initial rate of energy dissipation is greater than the previous curves, indicating that the greatest damping value can be obtained from this type of reinforcement at greater amplitudes of vibration.

The rates of energy dissipation obtained from the foregoing decay curves are more clearly illustrated in Fig. 11. The logarithmic decrements for a number of decay cycles were calculated from each film, and the resulting damping factors for the construction tested were plotted. Observe again that the damping factor for the conductor having no tie or no armor is virtually constant throughout the initial decay time and only a slight increase in initial damping. It becomes obvious, however, that with the application of aluminum armor and tie the rate of energy dissipation is noticeably increased. A further increase of energy dissipation within the initial region is observed from the data on the PFT armor tie. It can be seen that the curves tend to converge as the amplitude of vibration drops to a minimum, which is further evidence that the greatest amount of benefit in vibration can be obtained from reinforcing armor at greater amplitudes.

The use of pre-formed type of reinforcing is not necessarily confined to multiple wire stranded conductors for power transmission. They are readily adaptable for use on single conductor telephone lines as well. In this application they appear to have certain advantages also.

Telephone and Telegraph Lines

With a common type of insulator tie used in telephone construction the conductor is unprotected at the point of tangency with the insulator groove and also there is considerable chance for the tie to be loosened under vibration because the ends are unsecured. A telephone tie construction which would eliminate these points of weakness would be very desirable. Fig. 12 shows how the pre-formed reinforcing may be applied to remedy such faults. Observe that there are no insulator-line contacts, but that all contact takes place at the pre-formed reinforcing. Therefore, when conductor vibration takes place, the resulting chafing and abrasion will be born by the reinforcements rather than the conductor. As an additional safeguard against the maleffects of vibration, the tie wires are brought around the insulator neck and tightly

Fig. 12—New pre-formed armor tie

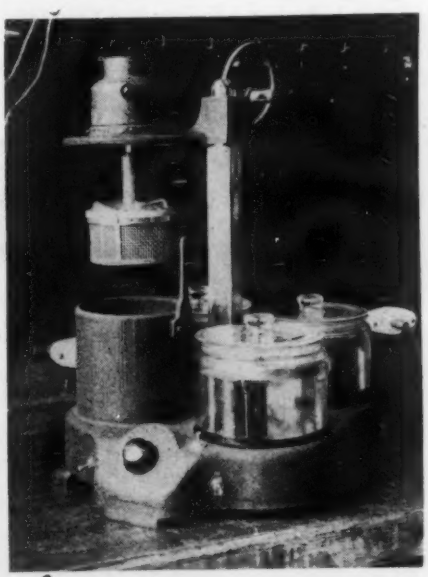
twisted, drawing the reinforced conductor against the insulator neck with sufficient pressure to minimize the motion between the components under vibration.

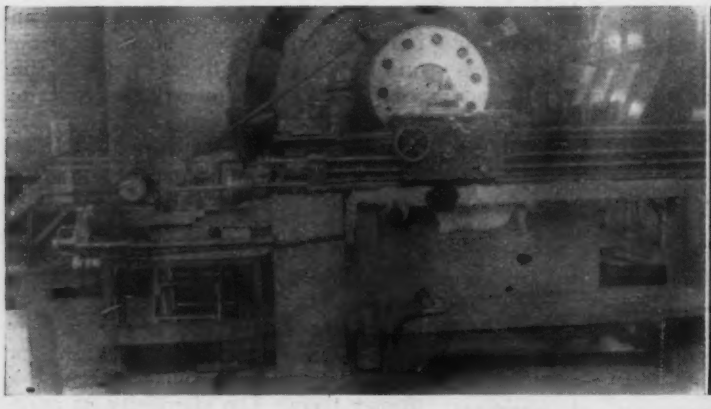
Vibration tests have been conducted up to 40 million cycles on each of the ties just described. Where the common horseshoe tie was used, the wire cross-section was badly abraded at the point of tangency with the insulator as well as a certain amount of wear being visible at the point where the tie wires were spiraled out. A section of conductor removed from the improved tie bearing pre-formed reinforcing and after vibration under conditions identical with those of the above case showed great improvement. Contact abrasion on the conductor itself was found to be virtually absent and abrasion on the pre-formed reinforcing was almost invisible. This result can be attributed to the firmness and tightness of the completed tie effected by twisting the tie wire on the insulator neck. The beneficial effects of such reinforcing on telephone and other lines of small conductor, in areas where vibration is known to be prevalent and destructive, immediately become obvious.

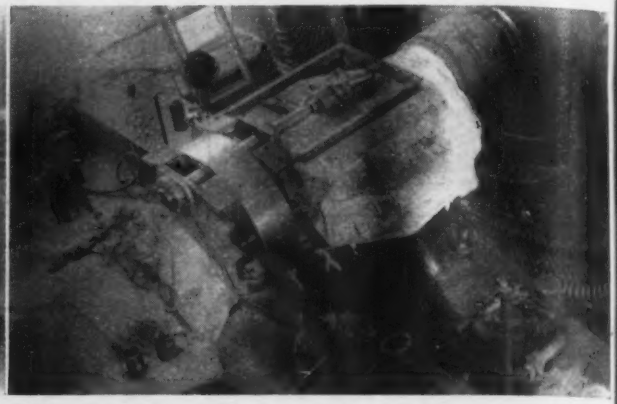
Criticisms centering around the apparent complexity of such an armor and tie system are to be expected from some sources. However, considering the relative inability of all but the armor type of pin insulator tie to meet satisfactory performance requirements, the question becomes reduced to choosing one type or another of armor tie. All other armor ties require either specialized tools, high skill to apply them, are composed of long lengths of tie wires very inconvenient to handle, or are of such complicated design that the average lineman has difficulty to master them. The simplicity of application of the pre-formed type of armor as well as the ease with which the tie may be applied to the armored conductor, are points which we believe, contribute to favorable acceptance.

Parts Cleaner

USE of the industrial cleaning machine illustrated has supplanted the slow and not too satisfactory tooth brush and solvent method of cleaning meter registers and other parts in the Oakland meter department of Pacific Gas and Electric Co. A variable-speed, motor-driven meshed wire basket, containing an inner finer meshed basket for holding the parts, is revolved first in a cleaning solution, then in a first rinse, then a second rinse and then dried in a metal container with electrically heated fan circulated air. A thermostatically operated speed control may be switched in so that the basket alternately spins fast and then slow to give an agitator action. About 20 minutes is required to clean badly gummed parts that formerly required up to two hours to clean by hand. The equipment is known as an L & R industrial cleaning machine.







Frequency Changer Major Overhaul

Step-by-step procedure given for reinsulating stator coils and major overhaul of 12,000-kw. frequency changer set, including refacing coupling by special lathe set-up and other techniques

R. K. Klumb
Southern California Edison Co.

EARLY in 1945 it was decided that measures should be taken to prolong the life of the stator coil insulation, which was being damaged by static discharge, in a 12,000-kw., 12,000-volt, 50- to 60-cycle synchronous frequency changer set at Vestal substation of the Southern California Edison Co. The machine had been in service nineteen years and was part of the capacity supplying a predominantly agricultural load which builds up rapidly during a warm spring and peaks in mid-summer. Changes were made in maintenance programs for other machines and an outside time limit set for the job.

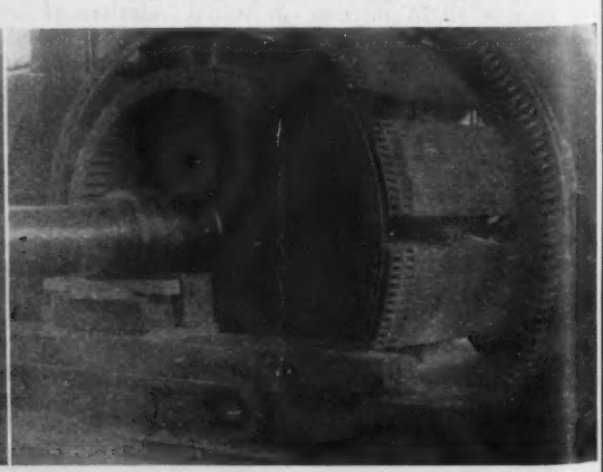
Insulation damage was progressively less from line to neutral so it was planned to interchange the line and neutral connections to put line voltage on the opposite end of the phase windings. Also the stator coils were to be rewedged where necessary to stop coil vibration in the slots.

When the rotors were removed, inspection of the stators revealed that all wedges were loose and would have to be replaced. Also the coupling faces were worn to the extent that proper realignment would be difficult. Plans were changed to rewedge both stators completely, reface the coupling flanges and fit new coupling bolts. The additional work had to be completed within the original time limit.

A supply of properly cured maple was obtained and work was started on the new wedges. When the old wedges were removed, a supply of new wedges was ready. The new wedges were delivered in batches that allowed this part of the job to proceed without interruption. New full-length filler strips were installed between coils and wedges and a short filler strip was put under each wedge at its final position. Single piece wedges were used entirely.

One coil side near a line terminal in each stator was lifted from its slot to determine the actual extent of insulation deterioration. Before lifting the coil sides and before putting them back they were thoroughly heated to soften the insulation and prevent cracking. Heating was accomplished by circulating direct current through the individ-

Lathe bed (top left) set up on concrete piers for refacing coupling flanges. A 10-hp. motor turns rotors and flanges. (Top right) Bolt holes in refaced coupling flanges were rebored with rotors in place by using air-operated, hand-fed drill. (Lower left) Rotor going back in place on 60-cycle end of machine. (Lower right) Rotor supported on stator to change point of lifting

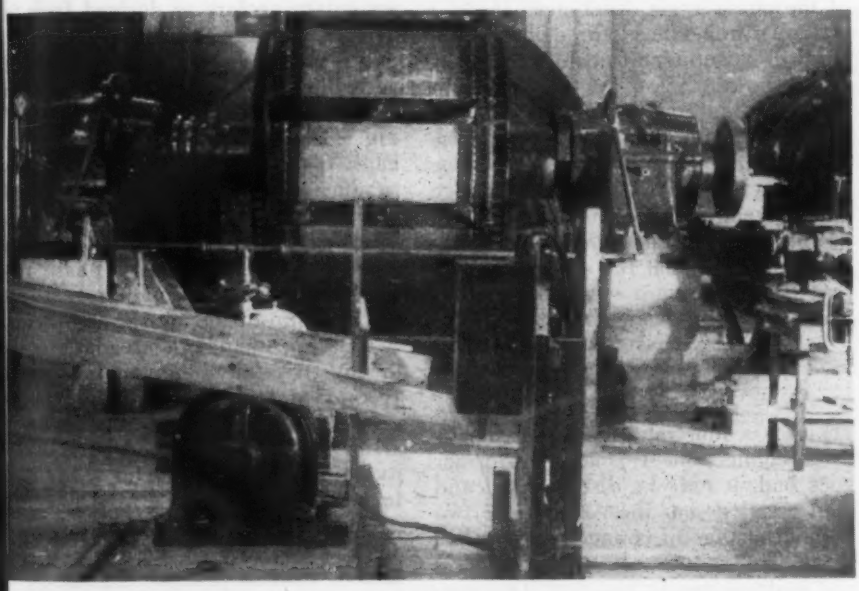


ual coils. After the rewedging was completed the individual phase windings in each stator were "meggered," then "hipotted." A potential of 19,000 volts to ground was applied for one minute. These tests were satisfactory and the connection changes from line to neutral were made.

Refacing Coupling

Work was started on setting up the rotors for refacing the coupling flanges at the same time that work was started on the stators. The rotors weigh approximately 35 tons each. The 50-cycle rotor has ten poles and the 60-cycle rotor has twelve poles. Over-all diameter of the rotors was 7 ft. 6 in. on one and 7 ft. 8¼ in. on the other. The poles were left in place on the rotors. The pling face, leveled, squared and bolted solidly to the piers. A ¾-in. steel plate was mounted over the carriage and the tool post was mounted on the plate. This was done to obtain maximum rigidity. A carriage travel of approximately 1/16 in. per minute was arranged. The tail stock, removed from the lathe, was set up back of the spur gear to take up end thrust from the cutting tool.

When the set-up was complete, high pressure oil was pumped to the bearings and when the shaft floated the driving motor and circulating oil pump were started. After the rotor was turning, the high-pressure oil pump was shut down and the bearing pressure maintained itself. Complete cuts were made without stopping. Measurements were taken after each cut and adjust-



Rotor is mounted on concrete pedestals ready for refacing of coupling flanges

istance between journal centers was 1 ft. on one rotor and 10 ft. 11 in. on he other. Suitable concrete piers were rected on the station floor and the two enter bearings and pedestals, removed rom the set, were placed on the piers, veled and centered for the 11-ft. rotor. rovision was made for shifting the edestal on the coupling end to accomodate the shorter rotor.

The first rotor was placed in the earings and the high-pressure oil system connected. A circulating oil system was connected from the bearing ells to the sight hole in the bearing aps to provide a continuous oil flow. 57-in. spur gear was mounted on the utboard end of the rotor shaft and a orm gear was fitted to the bottom of e spur gear. The worm gear was free slide on its shaft opposite to the rection of driving thrust and was iven by a 10-hp. motor belted to the aft. Pulleys were fitted to turn the otor 4½ r.p.m.

The 8-ft. lathe bed shown was set up concrete piers parallel to the couments made so that the final surfaces were within .0005 in. of being perfectly flat. Total thickness of metal removed from both coupling flanges amounted to 9/32 in. A filler plate of S.A.E. 1040 steel was made and finished to .271 in., plus or minus .0005 in., to take the place of the metal removed. The plate was drilled undersize for the bolts, center cut to fit the coupling hub and then cut in half on the center line. Having the plate in two pieces allowed easier installation after aligning the rotors.

The coupling bolt holes were bored after the machine was assembled, as shown by one of the accompanying photographs. The filler plate was put in place and the coupling bolted with two undersize bolts. The bolt holes in the filler plate were then ground flush with the holes in the coupling and the boring bar centered in the hole. The boring bar was mounted in ball bearings which were mounted on a welded assembly bolted solidly to the coupling. Turning power was provided by an air motor and the tool was advanced by hand feed. As each hole was finished it was measured for diameter and a bolt made to fit. The bolts were finished .0005 in. oversize and were driven in.

After the coupling was permanently bolted and the bearings assembled, the machine was put on test run to balance the rotors, check rotation and check bearing pressures. The end housings were then put on and the machine released for service several days before the time limit.

Air Circuit Breaker Development

INTRODUCTION of the "De-ion" circuit breaker nearly twenty years ago first met the demand for an oilless circuit breaker, members of the Pacific Coast Electrical Assn. were told at recent meetings by A. W. Hill, Westinghouse Electric Corp. This used an entirely new idea in de-ionizing the arc space within the breaker, he said. Developments cover the field of 7.5 to 15 kv. up to 500,000 kva.

Extension of air breakers to somewhat lower interrupting capacities was accomplished during the past ten years by the introduction of the type DH breaker. This breaker has substantial arc chutes of insulating rather than conducting material, with magnetic means of forcing the arc up into the chute as the contacts are opened. It is also used for indoor service and is arranged for truck type mounting in metal enclosures.

A newer type of indoor air breakers have from 500,000 kva. up to and including 2,500,000 kva. interrupting capacity. These are the type CA compressed air breakers, of which several hundred have been installed for ratings of 15 to 34.5 kv. Air from a common source at 150 p.s.i. is used for both closing and opening the breaker, as well as for extinguishing the arc. It employs a streamlined movement of air up through a blast valve for each phase of the breaker and then through the blast tube to the bottom of the interrupting chamber, where the arcing contacts draw out of the stationary fingers as the breaker is tripped. Where higher kva. duty is involved, a condensing chamber and muffler are added to the top of the interrupting chamber and the entire structure can be located in the middle enclosure for indoor application. In many instances, this breaker has replaced oil breakers for this type of duty.

Transformer Connections — IV Special

Fourth and last in a series of articles dealing with transformer connections and the resulting voltage and current relations

F. V. Gillum
Southern California Edison Co., Pomona

IN this fourth and concluding article on transformer connections the special cases of open-delta, open-star and zig-zag connections will be discussed. In Fig. 18a, a common delta-delta connection of three transformers is shown.

If one of the transformers should develop trouble, its primary and secondary connections may be cut clear and load carried on the remaining two, without changing connections and without resultant phase shift. The remaining two transformers then operate with what constitutes the open-delta connection. Primary and secondary vector diagrams 18e and 18f, are seen to be the same as for the original closed-delta connection. Note that in Fig. 18a, b and c, the current in each transformer at unity power factor load is in phase with the voltage of that particular transformer. Thus, current "a" is in phase with the voltage AB, current "b" is in phase with voltage BC, and "c" is in phase with CA.

In the open-delta connection of Fig. 18d, e and f, it is seen that the entire B phase line current flows through the left-hand transformer and that C phase line current flows in the right-hand transformer. "A" phase line current is made up of current flowing in both these transformers. Examine the primary winding of Fig. 18d. The line currents in B and C phase transformers are seen to combine on the common connection of the two transformers, which is supplied from A phase. Thus A phase line current is the vector sum of B and C phase currents, when both are reversed. Inspection of Fig. 18e reveals that in the open-delta connection, the individual transformer currents B and C are no longer in phase with the individual transformer voltages, as in the delta-delta connection of Fig. 18a, b, and c. It will also be noticed that in the left-hand transformer, current "b" leads the transformer voltage BA by angle Ø, and in the right-hand transformer, current "c" lags the transformer voltage CA by angle Ø. (At unity power factor load, Ø is 30°).

Assume a three-phase load at a power factor of 30° lag. Then the left-hand transformer will be operating at unity power factor and the right-hand transformer at a power factor of 60° lag. Thus the regulation of the two transformers will be different, and the third phase BC, being a resultant of the other two, will have a still different regulation. These relationships help explain two disadvantages of the open-delta connection, viz.:

1. Full transformer kva. capacity cannot be used for useful load because of the phase angle difference.

2. An unbalanced three-phase voltage will be supplied to connected loads of low power factor, the degree of unbalance being greater with heavy loads.

Fig. 19a illustrates the open-delta connection as usually found. Vector diagram 19d, shows the same voltage and currents as 19c in a form more useful, at times, than 19c. It is readily seen from this that the secondary current B is the vector sum of A and C when both are reversed.

Star-delta Connection

Fig. 20a, illustrates the common star-delta connection. If one transformer goes bad, it may be disconnected and load carried on the remaining two without change of connection or phase angle. This is the open-star connection and is illustrated in Fig. 20d. This connection has the same limitations as the open-delta connection, and is not recommended unless the primary neutral is brought to the transformers direct from the power source. The open-star connection finds practical application on 4-kv. three-phase four-wire primaries. With this connection, transformers with 2.4-kv. primary windings may be used. Fig. 21 illustrates the connections as usually found. It is seen that the connection is very similar to the open-delta. Comparison of Fig. 19 and 21 reveals the difference. The connection of either 21a or 21d produces identical results.

Zig-zag Connection

The zig-zag connection illustrated in Fig. 22 is sometimes employed when it may be desired to supply a three-phase four-wire load without any phase shift appearing between primary and secondary phases. A star-star bank might be used but for several reasons is not recommended.

The chief disadvantage of the zig-zag is that special secondary windings are required, in fact two separate secondaries per transformer. Inspection of Fig. 22 will show that each of these windings must have a voltage rating of the desired secondary phase to neutral voltage divided by the square root of three. Fig. 22c shows the individual secondary vectors as derived from the primary diagram, with due attention to polarity. These vectors are combined according to actual connection and produce the secondary diagram "d." Fig. 23a illustrates the connection of a bank of additive polarity zig-zags to produce a secondary diagram identical to that of Fig. 22. Another connection is shown in Fig. 23e which produces the same final secondary phase relations, although inspection reveals that the make-up of the zig-zag is different.

It is hoped that the reader, by following carefully the application of vectors to transformer bank connections, as presented in this series of articles, will gain confidence and ability to judge the correctness of transformer connections. Practice makes perfect, and the reader is urged to analyze carefully all the diagrams presented, then to practice on some connections of his own making.

Fundamental principles to remember as presented in this series, are:

1. Instantaneous current flow is "in on polarity, out on polarity."

2. Voltage vectors should have no arrows but should be correctly labeled. Voltage is observed between two points and "direction" of the voltage vector is from the point first named to the second point. Thus in Fig. 19d, the voltage vector A′B′ is drawn in the same direction as the vector from A to B′ of Fig. 19c.

3. Arrows should be placed on current vectors to show direction. It is essential to be consistent in the application of vectors. The author therefore suggests that arrows placed on connection diagrams be consistant with the actual or assumed direction of power flow.

4. It has been demonstrated in previous installment that at unity power factor, the current in a phase wire of a three-phase circuit is in phase with the voltage from that phase to neutral.

Fig. 18

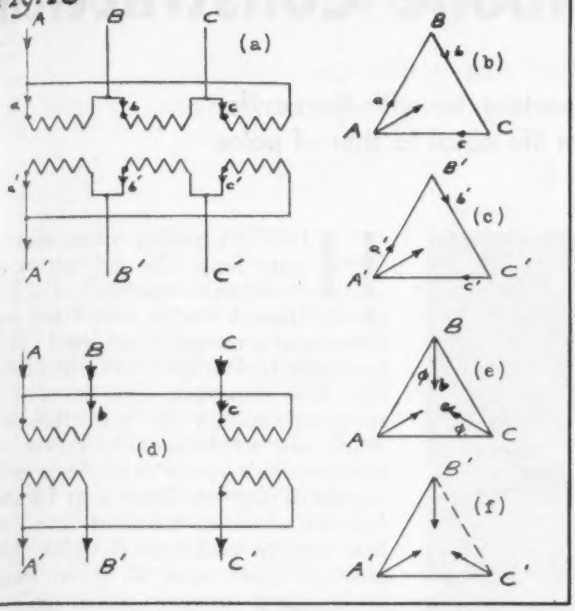


Fig. 19

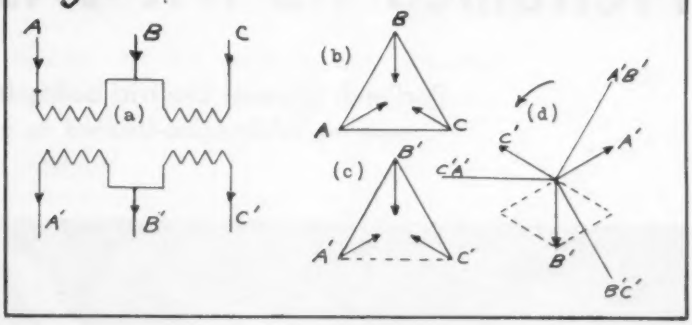


Fig. 20

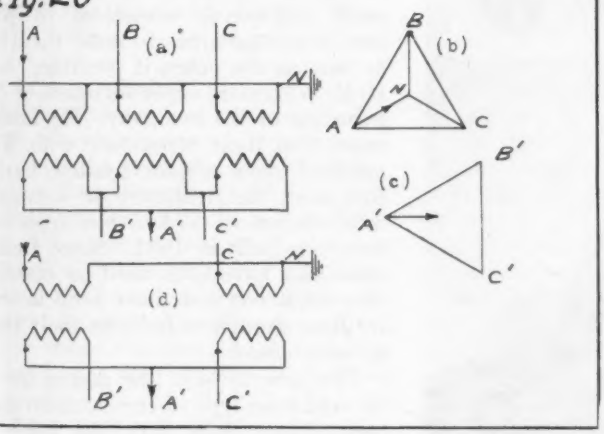


Fig. 21

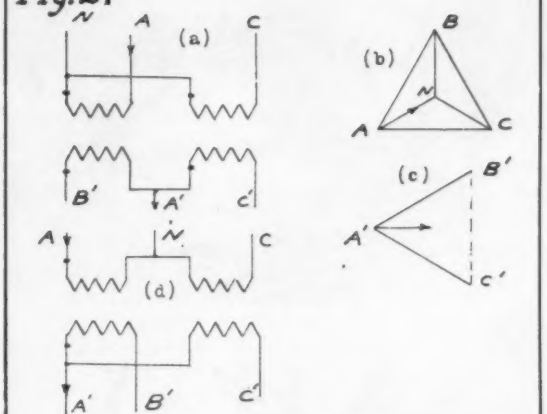


Fig. 22

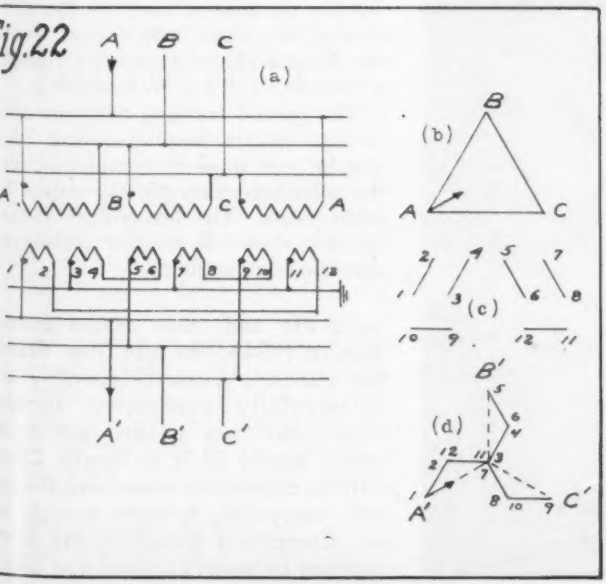
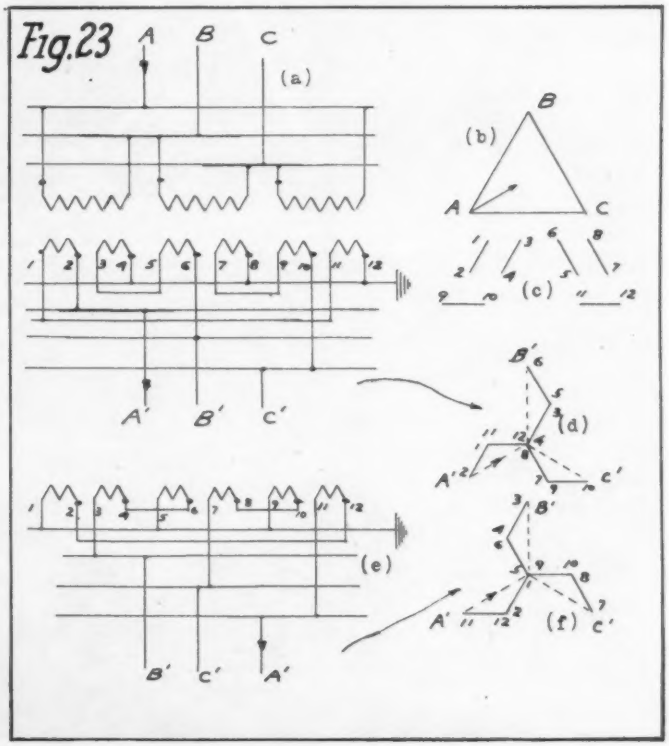


Fig. 23



Preframed 115-Kv. Wishbone Construction

Portland General Electric builds important tie with Bonneville. Crossarms Wolmanize-treated to give life equal to that of poles

HIGHEST quality materials to insure long life and setting the wishbone structures as a completely framed unit to save labor were features of a recently completed 115-kv. line built by Portland General Electric Co. This important link between the company's station "E" in Portland with either one of Bonneville Power Administration's two 115-kv. lines crossing the Willamette River near Linnton, consists of seven miles of line using best quality tank-treated cedar poles, most of which were 85 ft. in length, Wolmanized treated crossarms, and 350,000-cir. mil, bare stranded copper with average span length of 280 ft.

"Because poles were of top quality, we thought it advisable to make the small additional investment in Wolmanize-treated arms, to make them last as long as the poles, if possible," says H. R. Wakeman, superintendent of distribution of the company. He further states that their experience with Wolmanized arms is quite limited, having first used the treatment on a twenty-mile section of 57-kv., pin type construction built in 1941. Some treated arms also have been used on distribution work, but none have been in service long enough to indicate their resistance to decay.

The new 115-kv. line makes use of the wishbone type of crossarm arrangement. Two arms form an angle of about 45° for vertical and horizontal separation of conductors. The arms are 6x8 in., 12 ft. 8¾ in. and 15 ft. long. Timber Structures Inc., Portland, fabricated the arms which were sent to the Wauna plant of American Lumber & Treating Co. for Wolmanizing.

The special framing template shown in one of the accompanying photographs was used to completely frame the poles before erection to reduce field labor costs. The heavy-duty A-frame derrick, shown in another photograph, was used for setting.

Long life and labor saving methods feature 115-kv. line job. Top: Framing the wishbone crossarm assembly using a specially constructed template. Poles were top quality butt-treated cedar, mostly 85 ft. in length. Center: Setting completely assembled structure with heavy-duty A-frame derrick. Lower: Completed line along the arterial highway between Portland and Linnton

Power Salesmen Keep Learning Afresh

Pool their experience and keep adding to the pool in a continuous conference refresher program conducted by Southern California Edison

G. N. Hawley
Manager Commercial and Industrial Sales,
Southern California Edison Co., Los Angeles

DR. Nicholas Murray Butler is reported to have said that he doubted if any college president could get into his own college on his own entrance examination. That's about the way it is between power sales managers and power salesmen. What sales managers really need, they think, is power salesmen who are supermen, not over thirty years of age, with ten years experience in our own companies and backed by twenty years of technical preparation and experience in industry.

A power salesman, the sales manager thinks, should be the right combination of electrical engineer, mechanical engineer, metallurgist, lawyer, economist, welder, X-ray technician and supersalesman. Give such a man a thorough grounding in bakery and restaurant technique and have him brush up on his electronics a bit and you've got a power salesman who is really ready to face the postwar world!

The fact that no one has ever yet seen this paragon daunts us not a bit. Maybe he is now in a war plant just getting ready to settle down into the postwar security of a utility job. Maybe the chaps who come back from the armed forces will have this right combination.

At the same time we are continually being amazed at the magnificent performance of our present power sales forces. It may be that the tremendous production record of industry and agriculture in this war could have been hung up without the assistance of these men. But it is a fact, nevertheless, that utility power salesmen everywhere have rendered a great service to their country in connection with the conversion of industry and agriculture to war production. How great a service will never be known for it has been a strictly behind-the-home-front activity and there are no Army-Navy E's for that.

It will not even be fully known to the utility managements who employ them, for a great share of their effort has been on-the-spot help to industry right out on the production line and such things are not recorded on the service order.

Power salesmen in more than a few instances have shown less well trained factory men how to adapt old machinery to new uses, how to make electrical junk do the job of hard-to-get new equipment and how to squeeze a few more kilowatts through cables already groaning and sweating under their loads.

Whether or not the training and experience of these men comes up to the power sales manager's ideal, the fact remains that it has been sufficient to do a job of which they and their companies can be justly proud. And to say that such efforts have no salutary effect on a utility's public relations is to adopt the general attitude of "what's the use."

Readying for Reconversion

In the reconversion of industry and agriculture to peacetime conditions, power salesmen again are playing a prominent part. In many ways this job is greatly different from the previous one of war conversion.

Efficiency and economy, side-tracked somewhat during the war, again are becoming uppermost in consumer's minds. Costs of operation and maintenance will now become major factors as selling prices of products are again adjusted to markets. Output per man-hour and per dollar of invested capital may very well set the level of the postwar standard of living.

Those enterprises which fail properly to discriminate between true efficiency and false economy will likely not survive the business hazards of a peacetime world.

Substitutes for purchased power are always one of the cure-alls urged upon industry as a solution of its cost problems. In this coming struggle for efficiency, utilities are almost entirely dependent upon the effectiveness of their power sales staffs in preserving and extending their industrial and agricultural business. Sales management can only provide the tools; in the final analysis the job itself can only be done by trained manpower, effectively utilized.

Recognizing both the magnitude of the coming problems and the ability and adaptability of our present power sales organization, Southern California Edison's sales department has gone into training. Without attempting at this time to reconstruct either man or organization, the sales and personnel departments are collaborating in an experiment in adult education within industry. The approach to the problem is not new but its application to the complex business of power sales seems to be. Briefly the program incorporates:

1. Use of the conference technique.
2. Use of the power sales manual of the Edison Electric Institute as a text.
3. Use of a study guide to direct and control training.
4. Group conferences held on the job.
5. Special assignments to members of each group.
6. Use of consumer's plants as training material.

Throughout, the approach to the trainee has been on a thoroughly adult basis. No teacher-pupil relation is permitted to exist. No firm schedule of classes is set up nor is a deadline for completion established. The company provides the time and material for doing the job with the thought that those who take advantage of them benefit themselves as well as the company.

As a prelude to the program, eight conference groups were established in eight different areas of the company's territory. Sales engineers from two to five districts comprise each group.

Through consultation with the district managers involved, a group leader was selected from the members of each group. These group leaders then attended six two-hour sessions devoted to discussion of conference technique under the guidance of a well-known authority on the subject, Dr. Jackey of the vocational training department of the University of California at Los Angeles.

In these preliminary conferences the function of the group leader was defined and outlined, each group leader was given actual practice in conducting a conference and the content and scope of the training material was outlined. The function of the group leader as chairman and coordinator rather than as instructor was stressed.

The power sales manual of the Edison Electric Institute was selected as the best text available on the subject and a study guide was prepared to assist group leaders in carrying on

their conferences. This consisted largely of comments on the text by members of the general office staff familiar with the activities covered by the various sections of the manual.

For example, our air conditioning engineer prepared the section of the study guide dealing with that subject, pointing out the important phases to be emphasized in the conference, outlining the differences in local practice from that covered in the text and including a list of representative questions to be used by the group leader in stimulating discussion and keeping it pertinent to the subject. Thus, each group leader was provided with a section of the study guide for each section of the manual and the important factor of adapting the text to our local practices was covered. It has been said that the Edison Institute is now preparing a similar guide as an adjunct to the use of the manual.

Leaders Carry Program Back

Finally each group leader was definitely delegated the job of carrying out the training program of his group. On him rests the responsibility of locating a suitable meeting place, scheduling and conducting the conferences, planning the plant visitations and reporting the results to his district managers and the general office.

In this manner, each group is permitted to proceed at its own pace, to schedule conferences at its convenience, to introduce material not covered in the text and to obtain outside assistance from electrical manufacturers and from consumers.

In general, each group has elected to meet once a week for a two-hour session. Usually at each session one section of the power sales manual is discussed, having previously been studied by the members. An outline of the subject is evolved from the discussion and this, together with recommendations as to improvement in sales techniques or as to additional sales aids needed, becomes the report of that conference.

In this manner, not only does the group member cover the training material but he also participates in sales planning, contributing suggestions for improvement that are the result of actual field experience. Interspersed with the conferences are plant visitations and occasionally informative talks by manufacturers representatives and by members of the general office staff.

This training plan has been in operation since the first of the year; long enough to develop its weaknesses and to prove its advantages. In general it is the most successful scheme we have ever tried for this particular type of training job. It not only trains men in power sales techniques but it develops leaders also.

Through the discussion technique every group member not only absorbs the information but has a chance to "play it back". Since power salesmen are continually involved in important contacts with customers, this ability to "dish it out" is just as important as the facility to "take it".

Furthermore, we find our men eagerly accept this type of training and whole-heartedly participate in it. This is because it is man-to-man discussion and argument and in no sense schooling.

We believe now that no training plan that is not geared to such an adult conception of education can possibly be effective when applied to the calibre of men represented in our power sales organizations. We are convinced also that any training plan for power salesmen must incorporate opportunity and encouragement for free expression and practice in the presentation of viewpoints if it is to develop men capable of representing the company adequately. This is not to say that the conference plan is the best for all types of training; we have simply satisfied ourselves that it fits power sales training admirably.

To be truly effective, power sales training must be continuous. This is so because of the nature of the sales operation. One of the major functions of the power salesman is to bring to the attention of his customers the latest developments in utilization equipment and practices. To do this he must be provided with current information.

We have found the conference method a superior device for accomplishing this. It not only assures that current material will be received but that it will be fully explored and intelligently handled in the field.

It may be said with good reason that the power salesman's education is never completed. Training needs to be continuous for another reason. Sales groups are never static things. Turnover has been small in our company but transfers of men and reassignments of territory occur continually. As men develop and become more proficient, they are assigned to territories involving greater responsibilities. Thus, the character of the job itself changes and with each move the salesman faces new customers and new problems.

As the war draws to a close, additions to the sales force will be made. Some of these men will be drawn into sales activities from other departments of the company. Some of them will be returned veterans. Some will come from civil positions with other industries. All will require training in the complex business of power sales.

The building up of the force will be a gradual process. A continuous training program using the conference method is made to order for such conditions. By its use, new men get the benefit of the varied experience of those with longer service, a phase of training which is just as important as the contents of the text. The method is flexible enough so that a newcomer may join the conference series at any time with the assurance that he will eventually cover the entire field. He does not have to wait until a new semester or a new course is started.

Back-flow of Suggestions

Not the least of the results of our experiment has been the back-flow of practical suggestions for the improvement of the sales operation. Over two hundred worthwhile ideas have been developed in the conference groups and passed back to the management in the short while the plan has been in effect. These are the type of suggestions which are only uncovered by intimate contact with customers. These ideas cover improved methods of demonstration, use of new sales aids, more effective tie-in with direct-mail and other advertising, more efficient handling of contracts and work orders, suggestions for the use of display equipment, and test equipment, needed technical and sales information, and a host of others.

Not all the suggestions can be incorporated into our sales plans, but the majority can be and will be. Every suggestion, however, reflects the careful consideration and active interest of men who know their field problems thoroughly and are genuinely interested in doing a better job for their customers and their company.

Correcting Weaknesses

Some weaknesses have developed which must be mentioned. The first has to do with the composition of the various conference groups. Originally we made up the groups geographically. This was to save time and transportation. We found, however, that some groups were composed entirely of men with similar limited experience.

For example, in one of our groups in outlying agricultural territory all the men had excellent training in hydraulic and irrigation applications. None, however, had much industrial experience, particularly on welding and heating applications and the like. The success of the conference method depends largely on having varied experience within each group. In this case we brought in a new group leader and the plan worked well. A better remedy, we feel, is to change the make-up of the group, where this is possible, and get a broader range of experience into

each group. In one case, we combined two entire groups and secured better interest and progress.

A second weakness developed when new men without previous company experience were assigned to a group. Being in strange company and new to their jobs, they had difficulty in grasping the trend of the conference and were slow to participate in the discussion.

The remedy here is to provide some fundamental training before such men are assigned to a group. When hiring some salesmen for instance, we now give them a two-week intensive course in the fundamentals of the job and the over-all operation of the company. This is commonly done under expert tutelage in the general office before the man is assigned to his job. After that he has no difficulty in keeping up with the balance of his group.

There may be other weaknesses which have not come to our attention. One difficulty which we expected to develop but which did not do so, is the tendency for well-trained power men to regard their methods as professional secrets and refuse to share them with others. It is a tribute to the good sense and broad vision of our older men that not a single instance of this developed. On the contrary, the spirit of enthusiasm and genuine helpfulness which these men displayed is the backbone of the plan's success.

All in all, we feel that our experience with the conference method of training shows that it is a definite improvement over former methods used in power sales training. It appeals to the men, it provides training in good presentation, it develops leadership, it can be made continuous, it provides a vehicle for quick exploitation of new uses, it develops ideas for improvement of methods and, best of all, it provides *more* actual training than any method we have previously used. Experiment successful.

● KINNEY BROTHERS, Los Angeles distributor of household appliances, will start construction of a new headquarters building as soon as necessary releases can be secured, it was announced recently by Roland T. Kinney, vice-president. The new building will be located on S. Flower St. and will include offices, display rooms and warehouse facilities. The firm distributes appliances and radios in southern California.

● RADIO STUDIOS, INC., Salt Lake City distributor of appliances, radios and electronic equipment, has announced a change in name to Standard Supply Co. and a new location at 531 S. State St. Management of the firm remains the same.

They're Talking

about these things in the trade today

● AMONG the new ones to make washing machines will be F. L. Jacobs Co. of Detroit, with automatics (Launderall) and hand-fed models and they expect to have floor models by October.

● STROMBERG-CARLSON plans to start making home radios during the fourth quarter.

● ELECTRIC FAN production has started at Westinghouse, but hospitals and war plants have divvies first. Two models for bracket or desk use are being made.

● REMINGTON RAND will have electric shavers by fall for civilians, it hopes, although hospitalized service men get first call.

● BENDIX will make ironers and dryers in addition to its automatic washer, Bendix Home Appliances Inc., declares. Promises something as different in ironers as its washer was from the orthodox types.

● SOME WESIX heaters are appearing in dealer stores, not the ersatz kind, either, but the old familiar aluminum portable.

● MORE ELECTRIC RANGES were authorized by WPB for the third quarter and the fourth may have even more. Electric timers are still not permitted, nor lamps and accessories and oven racks can't be nickel plated. But there will be more ranges, at least.

● OPA has expedited its pricing procedure for the benefit of makers of new wares on which no previous ceiling has been established. This will apply to numerous new appliances and lamps. Regional offices work it out with local manufacturers.

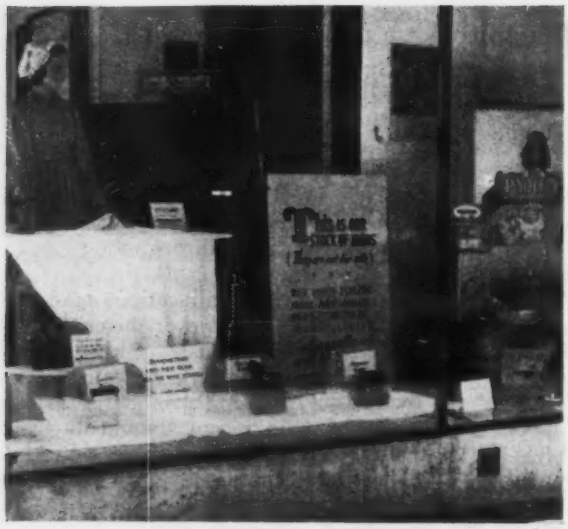
● NEW FM band allocations made by the FCC, which however mean the obsoleting of previously sold FM receivers, are declared to be satisfactory by Crosley, Philco, Stromberg-Carlson and others, in recent statements from their top men. All declare that this allocation gives definite place to both FM and television and enables them to go ahead with their plans.

● KELVINATOR too has come forth with a store planning service to dealers. With a huge 40-page, four-color display manual, it illustrates several styles of store interior—Colonial, Baroque, etc.—and not only illustrates the full store but details of display racks, platforms, backgrounds and furnishes working drawings or blueprints for them.

● PHILCO announced a nation-wide service program, with an association organization, membership, and other accoutrements.

● CROSLEY, taking its store modernization program to dealers in meetings, has dramatized the idea by an elaborate booklet, *Peter Van Modernizes His Store*. In it the Crosley institute takes a dealer through the various steps of modernization.

While in San Francisco for the PCEA conference, Mary Webber, General Electric Lamp Dept., Cleveland, who really knows home lighting, was asked to address a breakfast meeting of the San Francisco Unit, Northern California Electrical Bureau, at Western Merchandise Mart; 53, representing 34 firms, attended. She is surrounded, above, by the lighting committee—Frank Talcott, PG and E; Ed Dowd, Dowd-Seid Electric; W. O. Saxe, Sterling Furniture, unit president; Walt Thompson, Westinghouse Lamp Div.; Clark Baker, lighting counsellor, NCEB



Before electric irons again began to trickle into dealer stores, the Maxwell Hardware Co. store in Berkeley made an historical exhibit of museum piece irons, sad, gas, oil and charcoal, but told the window-shoppers that it had no electric irons in stock. "This is our stock. They're not for sale, but when electric irons are again permitted to be manufactured, Maxwells will sell them." Even the window dummy was from the good old days of grandma's sad old irons

● SYSTEMEERING is also being offered dealers by Universal's Landers Frary & Clark. Moderneering was the title given its store modernization service, in which leading experts from among architects, illuminating engineering, linoleum, glass and others gave practical advice. Systemeering is advice on financing and business organization of a dealer's business.

● COLONIAL RADIO has acquired a site in Riverside, Calif., for assembling radio sets. It is a subsidy of Sylvania Electric Products.

● CIO's United Auto Workers, according to *Tide*, is toying with the idea of pooling its members purchasing power to buy appliances and other products on a group basis at reduced cost.

● KAISER PRODUCTS of Oakland hasn't made public announcement yet but has been feeling its way to determine how to distribute the line of appliances it intends to make. It has a dishwasher that operates on water pressure alone, a tray washing machine, a refrigerator with a home freezer included and later may go in for ranges, both gas and electric.

● BANKS plan to supply all the credit service dealers may need in the field of appliance sales, says a survey by the American Bankers Assn., published in booklet form by the consumer credit committee. Arranged as a manual, it is titled *Home Appliance Financing* and outlines procedure for the purchase of dealer paper and wholesale floor plan financing.

● FIRST HEATING PADS since Pearl Harbor were announced by Casco Products Corp., Bridgeport. At first the production was restricted to supply the sick but now can be made for general civilian use.

● UPRIGHT HOME FREEZERS for city and farm homes, with front opening doors and sectional inner doors, were announced by Westinghouse. They will be about the same size as a large domestic refrigerator. This company has also started production of commercial refrigerators. It will merchandise its room coolers on a "try before you buy" program.

● MACY'S, the big New York department store, has bought O'Connor Moffatt Co., pioneer San Francisco department store, and intends to expand it after the war. Other San Francisco store news was that I. Magnin Co. would take over the building now occupied by Nathan Dohrmann Co., housewares and that F. W. Woolworth would tear down the Flood Building to erect a new three-story dime store on Market at Powell.

● EASY WASHERS may begin rolling out to the coast soon, if they can find the freight cars to roll in. The company started reconversion in May and expects to turn out models similar to its 1942 line in the fall. It also expects to make a clothes dryer.

● CONLON CORP. is prospecting for new appliances to make, and has appointed Sidney Krischer as consulting product development engineer to do the prospecting. Meanwhile it announced its distribution set-up for the country, with factory representation on the Pacific Coast. George H. Williams, Los Angeles; Arthur C. Maryon, San Francisco; L. A. Robinson, Seattle, and Great Falls Paper Co., Great Falls, Mont.; Ray Jones-W. S. Nocoll, Denver, are to be the representatives of the line.

● AVIATION CORP. bought Crosley after springing its own first ad on a new range. Just what will be the set-up is not yet clear. Crosley people say it doesn't mean any change in their already developed postwar plans.

● COLORED lamps can be made again. WPB lifted the limitation order, and colored fluorescents and flame tint, even Christmas tree lamps, can now be made.

● WATER systems are again being given promotion by the Plumbing and Heating Industries Bureau, address 35 East Wacker Drive, Chicago 1, by the production of a "proof" booklet, titled *Here's Proof of What an Electric Water System Will Do for You.* It is intended for distribution to farm customers by utilities and farm equipment dealers; was produced cooperatively by the Electric Water Systems Council.

● HEALTH-MOR INC., with a small vacuum cleaner in a bucket, called Filter Queen, which uses no bag, has begun department store salesmen training. Advance orders are taken after store customers see a demonstration.

● PLAN-A-KIT is offered by American Central Manufacturing Corp., maker of steel sinks, wall and base cabinets, to aid in kitchen layout. Plastic templates are used to spot the various appliances and cabinets on a floor plan.

● CONTROLS on making of most appliances have been lifted by WPB but it is up to the manufacturer to scout his own materials. Refrigerators, ranges and a few others are still on the critical list.

● G-E will distribute just about as it did before, said C. R. Pritchard, general sales manager. Examining the list of ways it used to distribute, there are few channels it will not use. There will be 60 wholesale major appliance outlets, 50 independents, and in seven big cities, Los Angeles among them, will operate its own major appliance wholesale branch; General Electric Supply will also distribute, and to go through the plumbing trade with dishwashers, sinks, disposals, Crane Co. will distribute. On traffic appliances all kinds of wholesalers will handle the line, as well as some drug chains, jewelry chains, Montgomery Ward and Goodyear. However, the company asserts, price protection through fair trade laws will be given all types of dealers.

● CROSLEY expects to expand its refrigerator capacity and has set aside its Richmond, Ind. plant for it. It has also announced a complete and novel line of kitchen cabinets and sinks. Meanwhile it has also announced that most of its major distributors are now equipped to service sealed-in refrigerator units in their local shops, speeding repairs.

Utility Merchandising Principles

PCEA endorses suggested appliance selling policy developed by Edison Electric Institute with national retailer organizations

AFTER careful consideration, the directors of Pacific Coast Electrical Association have given endorsement to the following suggested appliance merchandising principles. They were prepared by the Commercial Division general committee of Edison Electric Institute in consultation with the representatives of national organizations of retailers in all fields which handle electrical appliances. They were approved by these groups, which include electrical, home furnishings, hardware, department store and other types of retail merchants.

In issuing them, EEI recommends these as a guide to member companies in the formation of their own policies. They are based on the practice of most of the electric utilities which engage in merchandising of appliances as a means of increasing the use of their electric service.

In endorsing these principles, through their representatives on the board of directors, the member companies of PCEA in California, Arizona and Nevada plan to abide by these principles.

1. Sales Franchises

The merchandising policies of utilities should provide equal opportunities for dealers to sell any makes of appliances sold by utilities.

2. Sales Practices

Appliance sales should be made on the basis of fair and open competition, this being in the interest of the public, of appliance manufacturers, and of all those engaged in the distribution of appliances at wholesale or retail.

3. Quality of Merchandise

Appliances offered for sale should be of a quality which will result in safe, dependable and efficient operation.

4. Appliance Service

To assure a maximum of customer satisfaction, adequate maintenance service should be made available.

5. Sales Emphasis

Electric utilities should plan their appliance sales operations so as to encourage maximum volume by all outlets. Special emphasis should be placed on appliances and equipment not having adequate customer acceptance.

6. Special Offers

In planning special offers or sales inducements, the electric company should have in mind the importance of making it possible for retailers to join in, thus stimulating their merchandising activities.

7. Advertising

Advertising and displays should, so far as is practicable, recognize and support the retailers.

8. Deferred Payment Plans

Deferred payment plans applicable to appliances should be economically sound, and within the financing terms available to retailers. The merit of the appliance, rather than the terms of sale, should be the controlling buying motive.

9. Dealer Training

While training of retailer sales personnel is primarily the function of the retailer, wholesaler and manufacturer, utilities should consider offering basic sales training and information on appliance operating costs, on local installation policies and on competitive factors.

10. Compensation of Salesmen

In establishing compensation plans for salesmen, practices should be adopted which will lead to good will and understanding between electric utilities, retailers and the public.

They're Set to Soften the Big Market

Los Angeles dealers, distributors and utilities re-establish a sales promotional league to mass attack and capture huge appliance volume

WITH lots of electricity, low rates, a dynamic market, standards of living conducive to electrical usage, a large and growing population, youthful and modern in its ideas, the region around Los Angeles in southern California has everything to make it one of the best markets for electrical appliances and services in the nation. Yet with aggressive competition from natural gas and because the electrical industry has lacked coordination and dramatic campaign action, this market has never been fully developed. There were too many separated individuals and groups, each going its own way without respect for others.

To bring order out of this high-grade chaos, steps are now being taken by representatives of various factors in the electrical business in southern California through the organization of the Southern California Radio and Appliance Assn. Proceeding cautiously and thoughtfully, even though energetically, it hopes to avoid the shortcomings which have brought previous organizations of the kind to untimely termination, even if intentions were good.

In essence, the purpose of the new organization is to supply the mass promotion and sales direction to the entire industry which electrical leagues do in many Eastern cities and which was attempted previously in the Electrical Development League of Southern California. When appliances return to the marekt, everyone may be too busy for a few years to do a careful planning job. The time to do the groundwork is now, in anticipation of the big selling job ahead.

By having a promotional organization, geared to the job, and a program developed, the selling effort of all participants can possibly be made more efficient. Many of the unhappy trade practices which the unthinking may initiate and which can precipitate vicious reprisals may be avoided. Also many services which no dealer can afford by himself may be furnished by the pooled contributions of all.

Another factor which has made unity of program difficult in the area has been that electricity is served by a number of utilities, many of them municipal, and each with differences in policy and practices. Dealers in the area sell across the imaginary lines which mark the boundaries of each utility.

The distributors and manufacturers need distribution in the entire area, regardless of who serves the electricity. An urgent need to coordinate these factors is felt by the trade. It is hoped that, through the efforts of the association, more uniformity may be achieved and the market really opened up to the sale of electrical devices on a mass scale.

After considerable discussion and analysis, in which the need for a league or association strictly for promotion of usage of electricity was freely expressed, the various branches of the industry suggested representatives on a temporary board of directors. A tentative constitution and by-laws was drawn. It is being submitted to the legal counsel of the utilities, the individual national manufacturers and distribution companies and to attorneys for individual members. Nothing which even approaches violations of either spirit or wording of laws such as the Sherman Act will be permitted. Nor will political activity.

Objective of the association is stated in the constitution as being: "to promote the increased acceptance, purchase, and use of electrical appliances and radio equipment in this community; and to advance the common interests of persons or firms identified with the electric home appliance and radio equipment industry."

In the section on policies and practices, the association is declared to endeavor to: 1. Promote the sale of electrical appliances by sponsoring and coordinating industry-wide sales and advertising campaigns, adequate wiring promotions, sales personnel training, recruiting and selection programs, radio and appliance shows. (2) Promote a high standard of business practices by sponsoring a code of ethics to establish maximum confidence of the public in members' goods and services. (3) Promote understanding among members and the industry. (4) Provide representation for its members in local, state or national affairs of common interest. (5) Provide a source of information for members and the public. (6) Cooperate with other trade, sales, service, contractor or sales promotion leagues, bureaus, institutes and associations on matters of mutual interest.

Prohibition of engaging or encouraging any practices counter to law and price control is further stated and definite word that it will not engage in any political activity is also written in this constitution.

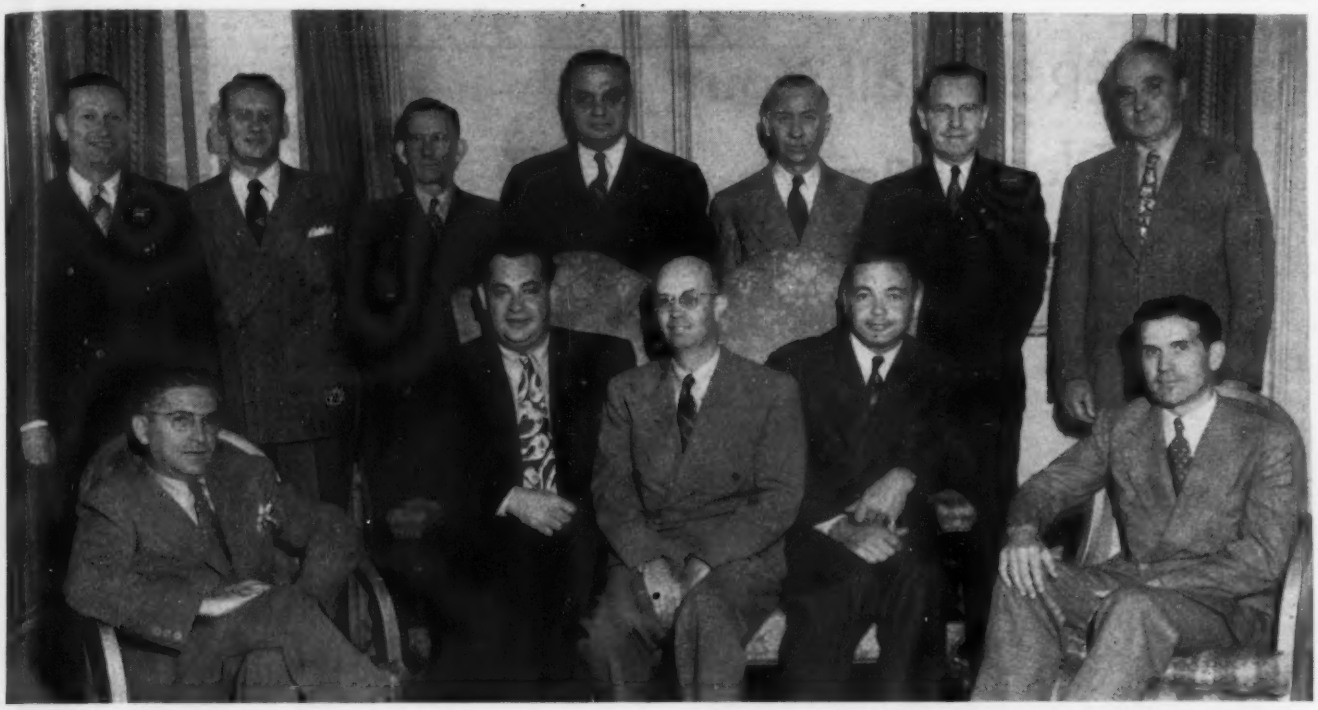
Membership in the organization will be sought among radio and electrical appliance retailers, distributors, manufacturers, service shops, parts distributors, electrical utilities, wiring and installation contractors or other related groups in the greater Los Angeles and adjacent area.

Several divisions of membership are to be set up. These are: 1. Retailers. 2. Distributors. 3. Manufacturers or their representatives. 4. Service shops and parts distributors. 5. Public utilities. 6. Wiring contractors.

Preliminary estimates set the potential membership at about 350, among which there would be 30 or more from the manufacturing and distribution branches, five or more utilities, the remainder retailers and contractors. Dues had not yet been determined by the temporary board, but were to be nominal and designed only to finance the operations of the association and employ a capable secretary-manager. Special campaigns to promote the sale of any particular service would be financed from the contributions of those interested in the particular program, it was believed.

In setting up the management, which is vested in the board of directors, the plan was to have that board composed of eight members from the retailers division, at least one of which was to be from the large downtown or chain store group, one the furniture, and four from the neighborhood dealer group; two from the distributors, one the manufacturers, the manager of domestic sales of each utility member and one from each other division.

Those selected for the temporary board to initiate the association were: *Radio and appliance retailers*—George Nicholson, Nicholson's Appliance and Radio Store; Ed Price, Price Bros.; D. C. Culbreath, Philco Radio Agency; Harry Chapman, Chapman & Perliter; S. A. Dinwiddie, Wilshire Refrigeration; Dave Langlands, Langlands & Schade; Jack E. Kaplan, Western Home Furniture Co.; *Distributors*—Walter Stickel, Leo J. Meyberg Co.; Ed Barnes, Nash-Kelvinator Sales Corp.; *Manufacturers*—Harry Fog-



Leaders in the organization of the Southern California Radio and Appliance Assn., and now its directors and officers: Left to right, back row: Howard K. Burdick, Los Angeles Department of Water & Power dealer coordinator; E. B. Barnes, Nash-Kelvinator Sales, distributor director; D. C. Culbreath, Philco Radio Agency, retailer director; Harry Fogwell, Thermador, manufacturer director; Dave Langlands, dealer director; George Hastings, Glendale Department of Public Utilities, utility director; S. A. Dinwiddie, Wilshire Refrigeration, dealer director. Front row: Harry Chapman, dealer director; Jack E. Kaplan, Western Home Furniture, treasurer; R. H. Cockfield, manager, residential section, Los Angeles Department of Water & Power, president; Walter Stickel, Leo J. Meyberg Co., secretary and distributor director; and Ed Price, Price Bros., dealer director. Several other directors are not shown.

well, Thermador Electrical Mfg. Co.; *Utilities*—F. V. Frey, City of Pasadena; George Hastings, City of Glendale; Charles S. Kirk, City of Burbank; Robert H. Cockfield, Los Angeles Department of Water & Power. Warren Penn, manager of Los Angeles Chapter, NECA, has represented contractors.

At the first meeting of this board, held in May, the officers elected were: *President*—R. H. Cockfield, manager, residential section, Los Angeles Department of Water & Power; *vice-president*—George Nicholson; *secretary*—Walter Stickel; *treasurer*—Jack E. Kaplan.

Five committees were also authorized with the following appointed as chairmen: *Membership* — Ed Price; *publicity*—D. C. Culbreath; *constitution and by-laws*—E. B. Barnes; *code of ethics*—Harry Chapman; *symbol, letterhead, etc.*—Dave Langlands.

For the time being, the entire board will act as a committee of the whole to develop a program of activities, set up a budget for the first year and decide upon a schedule of dues. It is hoped that the organization work can be completed before the summer ends so that sales promotional activities can be started in the fall.

Among the first projects considered on the program in early board meetings were the setting up of training facilities for dealer salesmen. The restaffing of dealer sales forces will require employment of a large number of salesmen, all of whom will need training, either as new salesmen or in refresher courses for experienced salesmen who have had no merchandise to sell for several war years. The salesmen's cooking school formerly operated by the Department of Water & Power was considered as a project which the new organization could operate in the future, rather than the utility.

Among other activities contemplated are conferences of dealers and distributors similar to those so successfully carried on by the Bureau of Radio and Electric Appliances of San Diego County, radio and appliance shows and expositions, special campaigns to tie in with national programs and publicity (such as refrigeration, electric kitchens, electric cooking, adequate wiring, indoor climate, radio, etc.)

Excellent example of the earnestness and simplicity of the program contemplated by this new organization to further the electrification of southern California was the terse but all-inclusive code of ethics submitted to the board for its approval at one of the recent meetings.

This code of ethics, prominently displayed in each member's store, gives his pledge to the public to—

1. Offer for sale merchandise and service of honest value.
2. Give a clear understanding of terms and conditions of sale.
3. Stand back of all pledges made.

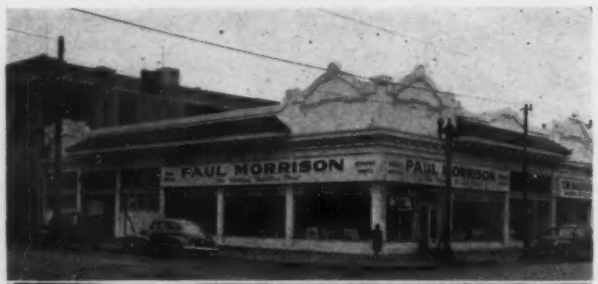
Aircraft to Washers

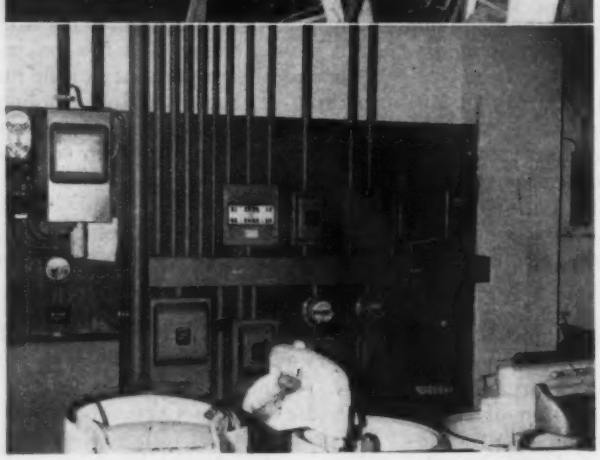
Announcing that the Rohr Aircraft Corp. of Chula Vista is planning to enter the washing machine and electric refrigeration field, Fred Rohr, company president, stated that his aircraft firm is now engaged in the making of tools and dies preparatory to the manufacture of these major appliances. Whether the washers and refrigerators will bear the name of Rohr, or that of a brand or trade name, has not yet been fully decided.

The belief was expressed that the fabrication of these parts would begin as soon as the War Production Board gives its O.K., and it was estimated here that such production might be underway "as soon as 30 days." Rohr only recently completed negotiations with the Detrola Corp. of Detroit for the production of radios, electronic devices, and automobile subassemblies, which will begin whenever materials become available.

DEALERS—Roll Your Own Planning—V

A case study of one who has





Paul Morrison and Stewart Menzies

PAUL MORRISON has been successful, selling washers and electrical appliances in Oakland for 25 years. Not only has he been planning but actually making as many of the changes he wants for his postwar business as possible under present conditions. Twice the building he occupied was sold from under him, so he bought one of his own, at 201 East 12th, large enough for future expansion (Fig. 1). He rents two stores now which can be later used for his commercial refrigeration, air conditioning and industrial infrared department. Ample window space will provide well-lighted displays to passers-by on heavily traveled 12th street. New fluorescent lighting and store front are planned.

The appliance sales floor (Fig. 2) is equipped with base cabinets, sink and wiring for two electric kitchens. When packaged cabinets are available these will be installed instead. Meanwhile, the display room looks occupied and second-hand ranges, lamps and available accessories dress it up 'til new wares arrive.

Orders for appliances, many with cash deposits, are being taken now. A big prospect list of past customers and all the appliance repair customers of recent war years is ready for the force of salesmen Morrison plans to employ and train. Kitchen and laundry plan service and work with the architects are contemplated in order to sell complete jobs. Provision for handling radio and television sets has been made. An acoustically insulated listing and closing room has been fitted up. All it needs is merchandise.

Especially proud of the service show (Fig. 3) is Stewart Menzies, sales manager. Repair service, which Morrison has provided customers in the entire Bay region for 25 years, will continue to be featured. With five well-equipped benches, lathe and tools, a modern spray booth and a special vacuum cleaner department, the planning in this department has already been put into practice.

And there is ample electrical capacity throughout the building. The main switchboard has a 200-amp. switch, fed by 350,000 cir. mils cables. There are 220-volt as well as 110-volt outlets throughout shop and display floor, so that ranges, water heaters, clothes dryers and any other appliance can be plugged in and demonstrated. The kitchens will be "live" demonstration kitchens in every sense.

In brief such is the planning of Paul Morrison, who has made such a good start toward fulfilling his plan.

Prepared by Pacific Coast Electrical Association Planning Committee

It's All Welding — But It's Different

First of two articles on welding experience in a Western manufacturer's plant which should be a guide to other users of machine welding processes

C. A. Rowley
Electrical Engineer, Thermador Electrical and Manufacturing Co., Los Angeles

TO THE LAYMAN it is all arc welding. To the more informed there are many varieties of electric welding, each with its peculiarities and special techniques. To the power company, welding of any kind has been a matter of concern because of its peculiar load characteristics. To the contractor installing equipment for welding service and to the electrical inspector computing sizes of feeders, fuses, switches, etc., welding has been somewhat of a mystery and a headache.

This has been true because welding is relatively new. Enough experience with it had not been gained prior to the war to be reflected in the National Electrical Code nor in other data pertaining to operation of welding equipment. However, during the war the shipyards have furnished the experience previously lacking on straight arc welding and many industrial plants have had extensive experience in other types of welding from which data can now be compiled.

As Thermador Electrical Mfg. Co. converted to war production, experience was gained in many types of welding as well as in the provision of facilities to serve welding loads. From this wartime experience the viewpoints of many in the industry in the West can be brought into a more realistic focus.

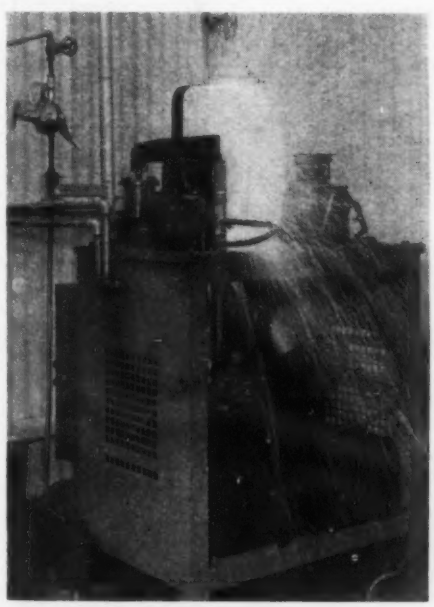
Before going into Thermador's experience it may be well, for the benefit of many who know little or nothing about the fine art of electric welding in any of its several forms, to give a somewhat elementary review of the subject. In this first article that will be done. In a second article the specific experience at Thermador will be discussed and the results obtained from it brought to definite conclusions.

Two Basic Types

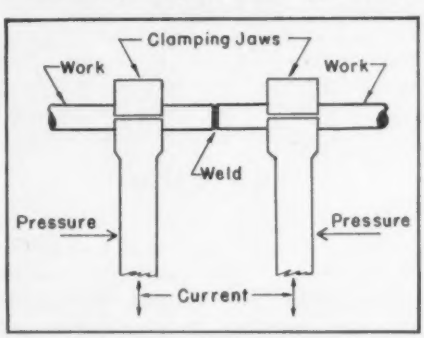
There are two basic types of electric welding. These are hand welding and machine welding. They are unlike in the following three principal respects:

1. The former, hand welding, requires a high degree of specialized skill on the part of the operator, while the latter is largely a matter of acquired dexterity in feeding materials to and from the machine.

2. Hand welding, usually referred to as arc welding, consists of uniting the parts to be welded by *adding* melted metal and a chemical flux to the joint and fusing all into a solid mass. The heat for this operation is generated by a low-voltage, high-amperage direct current obtained from a motor-generator set or an electronic rectifier. Heavy, extra-flexible, insulated cables lead from the source of power to the work. They are connected, one to the work, and one to the hand tool which grips the flux-coated welding rod (usually about 1/8 in. in diameter). When the welding rod, or electrode, contacts the parts to be welded an intensely hot arc is generated. This melts the rod and the metal around the joint together into a pool which, when cooling, makes a perfect weld.



Flash welder, 75 kva., designed and constructed at Thermador to weld bands. In the diagram below is illustrated the principle of this type welder



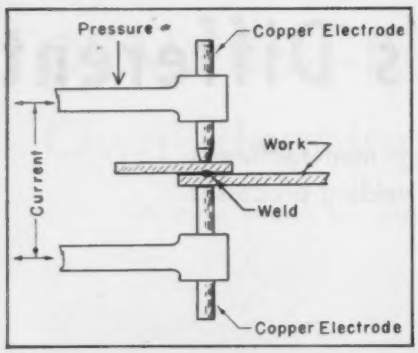
In contrast to this operation, machine welding joins the parts *without adding* either flux or welding rod. Low-voltage, high-amperage, a-c power, supplied from special transformers, is applied to the parts to be joined by means of hardened copper electrodes, applied one to each side of the joint, and forced together under considerable pressure. The weld is accomplished by the heat generated at the high resistance point of contact between the parts. This heat is so intense that the metal in contact liquefies and flows together under the electrode pressure. The melted metal cools immediately when the circuit is broken, leaving the parts securely "frozen" together.

3. The third fundamental difference between hand and machine welding is that while the former is essentially a slow, painstaking operation, ill adapted in its usual form to high-speed automatic production, the latter is just as surely perfectly adapted to both high-speed and automatic operation. Once the pattern is set and a machine welder adjusted to that pattern it will repeat its assigned operations day in and day out with almost automatic precision.

It so happens that the materials of war turned out by Thermador require practically no arc welding. On the other hand, they do require a wide variety of machine welding.

Types of Machine Welding

Machine welding can be broken down into an imposing list of types, but on close inspection many of these are found to be only special adaptations of one basic principle. For instance, spot welding, the most glamorous and widely publicized welding method, is a basic type of machine welding, while tack welding and gun welding are only adaptations of it. Flash welding is distinctly individual, as also are seam welding and projection or pressure welding. All of the above methods are extensively used at



How spot welder operates. The tack weld is made same way for "basting"

Thermador so each will be discussed at some length.

Spot Welding

As mentioned previously, spot welding is quite common. It breaks into print more often than other processes and is therefore best known to the lay public.

Basically it is very simple. It comprises only a step-down transformer, a pair of heavy copper arms holding the welding points and either an electric- or air-driven prime mover. The lower arm is usually fixed and is so related to the movable arm, which is hinged at one end, that they can be closed like a pair of shears, bringing the welding points together.

The materials to be welded, usually sheet metal, are overlapped and inserted between the electrodes, resting on the stationary one at the exact point where the weld is to be made. The operator brings the movable arm down by foot pedal or other means, gripping the metal between the welding points under pressure. At the same instant the automatic timer causes current to flow through the electrodes and the sheet metal between them, fusing the latter together at the point of contact. The timer interrupts the current flow and immediately thereafter releases the pressure on the work, allowing it to be moved into position for a new weld.

The time for each weld is not measurable in conventional units; instead the operation is usually referred to as lasting a certain number of cycles or fractional cycles.

On production jobs machines are usually fitted with automatic drives which bring the points together in a continuous series of rapid strokes so long as the operating pedal is depressed. The operator moves the work to a new position after each stroke, thus producing a dozen or more welds in the course of a few seconds.

Even with such rapidity it is practically impossible to keep welding current flowing even 50% of the time. Even the most skillful operators fail to do so. This is because of the lapse of time between welds and other delays caused by laying down one assembly and picking up another.

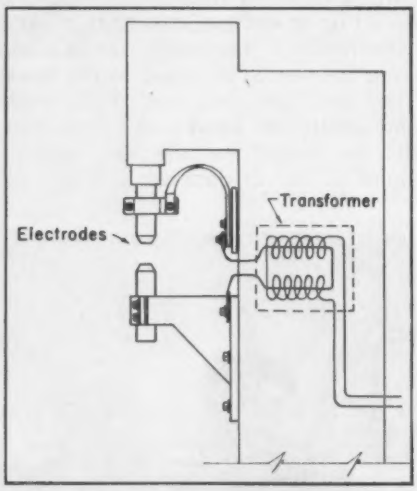
The ratio between actual welding time and the total time a machine is in use is known to the trade as "use cycle" and has a direct and important bearing on circuit calculations, as will be mentioned later.

Tack Welding

Tack welding is a modification of spot welding, usually employed to hold parts temporarily in position until they can be permanently joined by a seam welder. Tack welding is to the trade what "basting" is to the seamstress.

Gun Welding

Gun welding is essentially a spot welding operation in which the welder



Schematic of a typical spot welder rig

is brought to the work instead of the work being brought to the welder.

In other words, the movable arms and welding points are portable within a limited range and can be manipulated into positions not possible to reach with a stationary machine. The gun with its million circular mil, water-cooled cables, is bulky, with an air motor, etc., and is too heavy and cumbersome for easy handling. It is usually attached by a short chain or steel cable to a long arm of a swiveled lever suspended from above. Moreover, it is perfectly counterbalanced by the transformer secured to the short end of the lever. The operator needs only to supply enough energy to raise and lower the balanced mechanism and rotate it through the arc of operation afforded by the length of the suspended lever.

Flash Welding

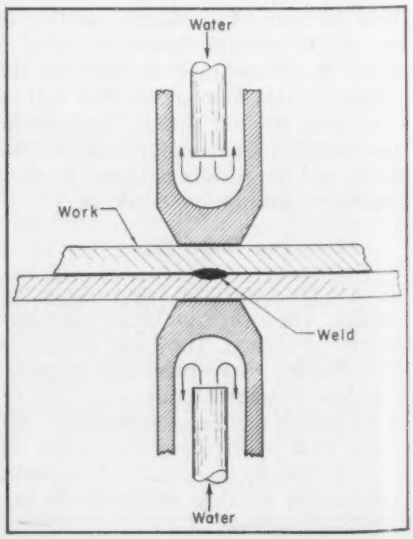
Flash welding, sometimes called butt welding, consists of fusing two pieces of metal, or the two ends of a single piece formed into a band, by butting the ends together under considerable pressure and simultaneously passing a heavy current through the joint. The heat generated at the exact point of contact flows the metal of the two ends together into a perfect weld as strong as the original material. The operation is accomplished by a spectacular flash and a heavy shower of incandescent metal, which accounts for the name "flash" welding.

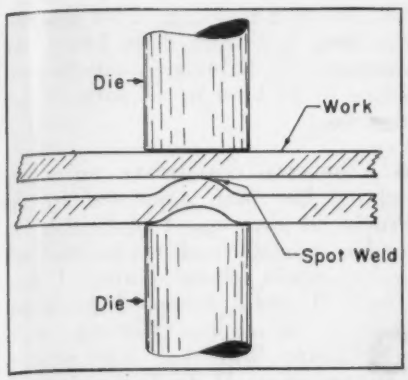
Seam Welding

Seam welding is highly interesting. The machines are ponderous and extremely complicated. From the standpoint of results obtained they function very much like a sewing machine. Two or more pieces of sheet metal, previously overlapped and tack-welded in position, are passed between hardened copper wheels with approximately ¼-in. faces contacting opposite sides of the work under considerable pressure. One wheel is power driven at a speed intended to move the work at the rate of approximately 4 in. per second.

The automatic timer is adjusted to energize the wheels at the instant they close on the seam and lateral travel begins. From 30,000 to 40,000 amp. of current continues to flow through the joint from wheel to wheel at split-cycle intervals so closely spaced that the result is a virtually continuous air and watertight weld from one end of the seam to the other, which is limited in length only by the depth or throat of the machine. These welders perform equally well on longitudinal or girth seams and require relatively simple changes from one to the other. On account of the extremely high current densities employed in seam welding the actual weld takes place under a flood of water pouring over the wheels and work to avoid destructive overheating during the operation.

Water cooled spot or gun welding electrodes are operated on this principle





Principle used in projection welding

Projection Welding

Projection welding enters very largely into products put out by Thermador. It takes its name from the projecting points of metal set up on the surface of one of the two members to be joined.

These projections are produced by heavy prick-punching from the opposite side which forces out little points, about ⅛ in. in diameter and 1/16 in. high.

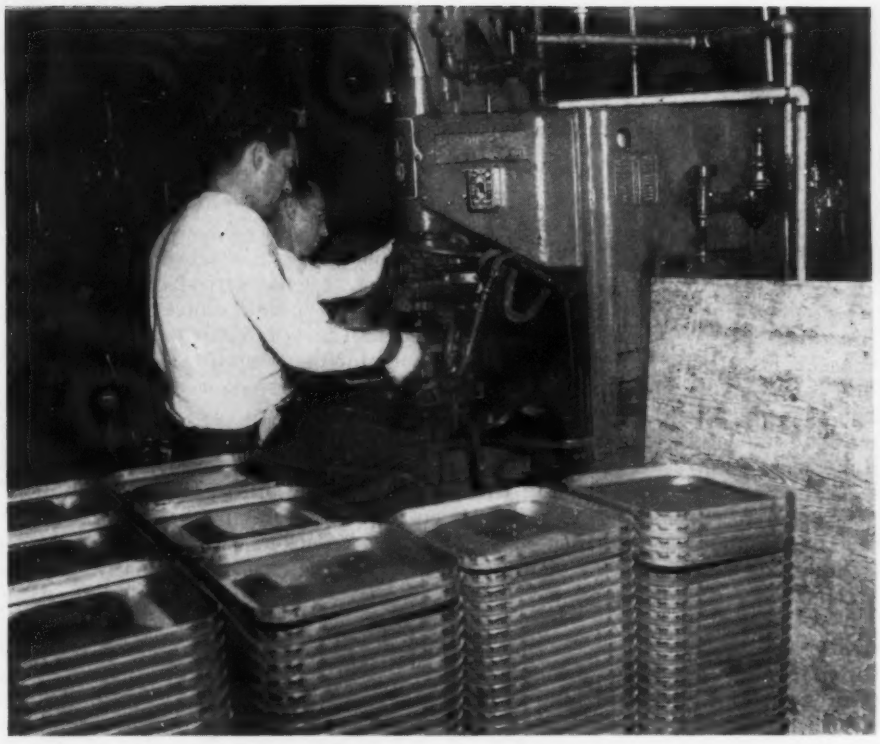
In the welding process these points are first forced against the flat surface of the second member and then are fused into that surface by the heat of a heavy flow of current. As the points slump under pressure the parts come into complete contact and are held in place by the rapidly cooling fused metal.

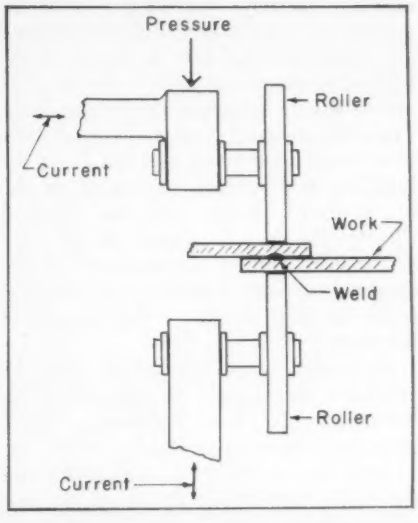
Machine Arc Welding

Just to make the record complete there is another type of welding machine used extensively in shipyards which is an adaptation of hand welding. It is an automatic welder which feeds the rod, sometimes in the form of heavy wire, to the work by means of a motor-driven mechanism, which also deposits welding flux ahead of the arc, draws up the surplus in a vacuum cleaner arrangement back of the completed weld and propels the mechanism itself along a seam which is to be welded.

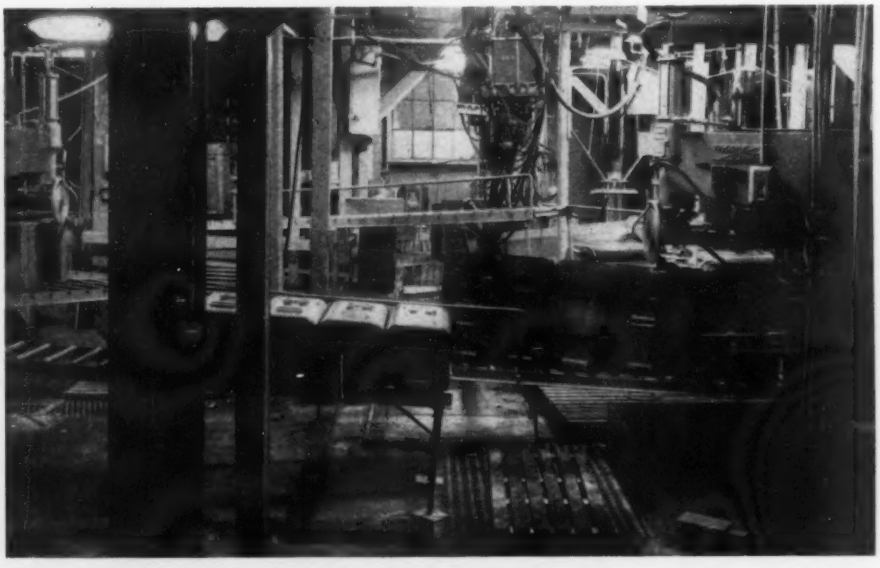
This review of welding methods may be elementary to some, but to many it may prove clarifying. It is all called welding, but there *is* a difference. The arc welding methods are particularly applied to fabricating of large metal structures, ships, building frames, large pieces of equipment, even to large motor frames. The machine welding methods are a boon to the factory producing many parts of metals. They are particularly useful in mass production.

In the second article, in the October issue, some of the specific uses of machine welding at Thermador will be described but with the end in mind of telling what has been learned about the wiring required, the fusing and protection, the servicing of equipment and the character and diversity of the power load, most of it *Not Found in the Books About Welding.*





Above, a typical projection or pressure welder, water cooled, in operation. At right, the principle of the seam welder. Below, part of the ammunition box production line at the Thermador plant. There are two seam welders, each of 150 kva., at the extreme left and right. In center background are suspended two 50-kva. gun welder assemblies, which being counterbalanced, are lowered easily to insert the guns inside the boxes for a number of welds



Trolley-Duct Makes Lighting Versatile

Changing demands in San Diego parachute plant can be met easily by shifting fixtures to suit

BECAUSE it had expanded its facilities to meet war production demands several times and each time had to rearrange lighting, with consequent rewiring and relocation of outlets, Standard Parachute Corp. of San Diego recently had installed an extensive trolley-duct system for its lighting which will give it utmost flexibility to change and rearrange lighting from now on. A recent addition to its plant was thus equipped and the idea appeals so that other portions of the plant may be changed over to a similar system.

The new addition is a completely windowless plant, with typical mill construction and open beam ceiling. Nature of the work requires long tables on which the parachute material is laid for cutting by means of power fabric cutting machines. Lighting is now arranged to run parallel to the tables and over them the full 100 ft. length of the building, the rows being about 8 ft. apart. When installed, eleven two-lamp Tru-Ad industrial type fluorescent units were suspended from and fed from the BullDog trolley-duct, mounted on the lower chord of the steel roof trusses. The trolley-duct is affixed to the edge of 2 x 8-in. timber suspended between the trusses, which stiffen the building frame as well as give solid support to the duct.

However, if several units may be needed concentrated at any one location, say for close inspection work, they may be moved easily to the required area, connected to the duct and the units may either be mounted parallel to the duct or at right angles to it.

The cutting tools, using three-phase motors, are not served from the duct, but have separate outlets provided for them. The lighting is on single phase. Cord for the cutting tools is suspended on a steel messenger cable looped on pulleys which can be moved along to suit the operator.

This installation was designed and installed by California Electric Works of San Diego, and the job supervised by Dick Becker, assistant superintendent of the wiring department.

Lighting Letters

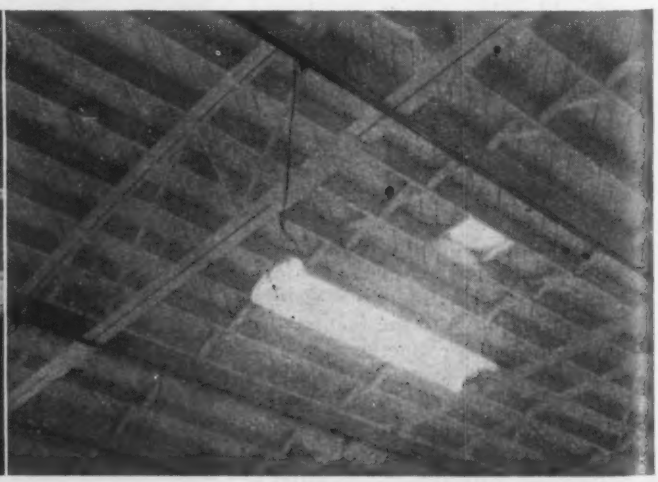
Direct mail on lighting of commercial buildings has been resumed by the Department of Water & Power, Los Angeles, according to Ted Shepherd, illuminating engineer. A series of illustrated letters is going to each of various types of business and to owners of property, refreshing their minds as to the advantages of lighting and advocating planning for relighting as soon as equipment becomes available.

Another series of letters is being directed to new tenants of commercial buildings. The names of such new tenants is furnished by the commercial department upon application for service. The letter thanks them for signing for service, expresses wishes for their success and offers the service of department illuminating specialists to survey and make recommendations for lighting to fit the particular business and building. Fine response has been had from these letters and interest in lighting modernization seems to be keen in all parts of Los Angeles.

● A SPECIAL COMMITTEE on school lighting has been appointed by the Provincial government of British Columbia to study and recommend improvements in school lighting. It consists of Harold L. Campbell, municipal inspector of schools, Victoria, chairman; Henry Whittaker, chief government architect; H. L. Taylor, government inspector of electrical energy; E. G. Daniels, government school inspector and R. F. Sharp, committee secretary, vice-principal of Magee High School, Vancouver, B. C. The report of this committee recommended extensive modernization of lighting equipment, pointed to the backward condition of lighting, stressed the need for maintenance of fixtures and bulbs and made a strong recommendation for the installation of germicidal lamps. Natural light, colors and reflection factors of walls and ceilings, and even special blackboard illumination was recommended in the future, if not initially, in the design of new school buildings.

● ALUMINUM RAILINGS of three members, the top one to contain cold cathode lighting tubes, will be installed on each side of the roadway on the top of Grand Coulee Dam, in Washington, according to Frank A. Banks, regional director, Bureau of Reclamation. Aluminum will be chosen to symbolize the role of Grand Coulee power in the light metals industry and because of its tarnish resistance. The 4,000-ft. railings will be designed to direct the light to the roadway and provide a glareless light source across the dam. After the war, travel across this roadway, now restricted, will be permitted again.

Industrial fluorescent units mounted on trolley-duct which is supported from 2 x 8 timbers between the steel roof trusses



Who

Lang & Stroh Co., food brokers, 204 Davis St., San Francisco, Carl Max, owner. Lighting design by C. L. Daly, illuminating engineer, Pacific Gas and Electric Co., San Francisco division. Installation of lighting and wiring modernization done by Weber & Conroy, electrical contractors, 30 Erie St., San Francisco. Acoustical-Celotex installed by Western Asbestos Co., San Francisco.

The Need

Modernization of old, store interior type of office to provide better working conditions for food brokerage office, where considerable eye work on office records is done.

Conditions

Formerly finished in tongue-and-groove lumber, painted brown or dark buff, the room, 21 x 56 ft., was completely refinished, with Acoustical-Celotex on the ceiling and Sheetrock on the walls. Walls were painted light green, ceiling an 85% reflection factor flat white. Venetian blinds painted in light green were put over the large store type front windows. Desk tops were recovered with a light toned mottled linoleum.

Installed

Two rows of Mitchell URC fluorescent units lamped with four 40-watt F white lamps, on 10 ft. centers, 10 ft. 6 in. from the floor, a total of 22 units.

Results

Before installation illumination was uneven, and 10 f-c the maximum. After installation, intensity was 75 f-c over the entire room.

LIGHT FOR AN OFFICE

FLUORESCENT

The Need

Adequate but unobtrusive illumination in the office of an executive, in which staff conferences are sometimes held.

Conditions

Area of the office is 420 sq. ft., with ceiling approximately 8 ft. height. Walls and ceiling finished in light tones. Windows with venetian blinds also painted light color.

Installed

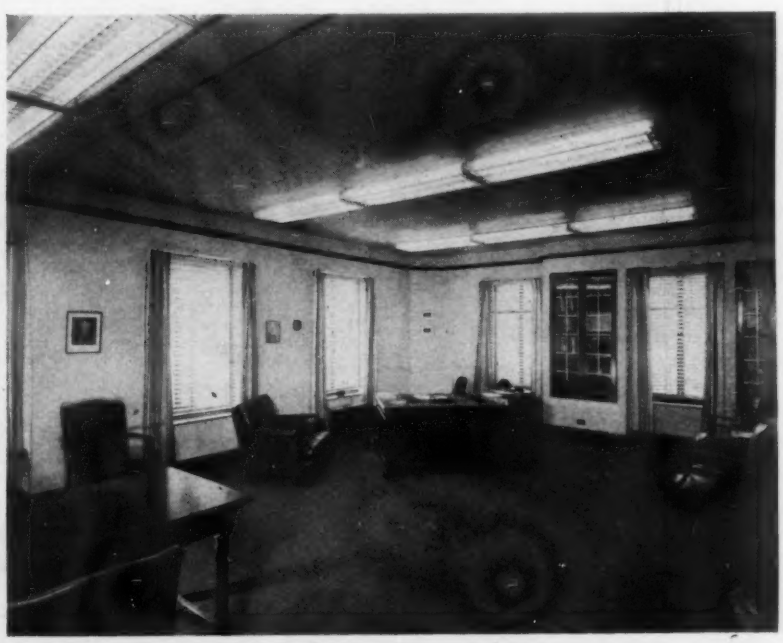
Three rows of three each Leader VL-440 fluorescent fixtures mounted against the ceiling, each lamped with four 40-watt F white lamps, a total wattage of 1,440.

Results

Illumination level at the desk tops is 73 f-c. Similar installation and levels in adjoining secretary's office.

Who

Office of A. S. Moody, commercial vice-president, General Electric Co., Portland. Installation made by Jaggar-Sroufe Co., electrical contractors, Portland.



Wiring the UNCIO

Contractor provides the wire services with power

A TREMENDOUS trifle in the United Nations Conference held recently in San Francisco was the special wiring which had to be provided for service to the many facilities put at the disposal of the delegates and for the uses of the State Department itself. This story of behind-the-scenes preparation can now be told.

When the Pacific Telephone & Telegraph Co. was asked to put in communication lines to reach all over the world, space was allotted in the war memorial group of buildings for telephone distribution centers. L. Roy Moser, San Francisco electrical contractor, was engaged to handle the wiring both for this main distribution center and for a number of secondary hookups.

In the War Memorial Opera House, two main distribution boards were set up, one in the basement and another on the first floor. From these, main connections were made to the offices provided for all nations represented.

A similar set-up was made for the United States Signal Corps on the fourth floor, where all military communications were concentrated and teletypes provided with power.

Each teletype or other electrical device used had an independent circuit. All circuits were run on the floor in surface floor duct and provided with independent outlets. The outlets were equipped with grounded receptacles to provide vitally needed ground circuit for all equipment.

In conjunction with the main facilities, similar groups of facilities were set up at the Fairmont Hotel and these were tied in with the Signal Corps.

Although of a temporary nature, the installation was made a first-class job in order to assure absolute continuity of operation. This proved worthwhile for, of the 380 circuits, none blew a fuse during the entire time of the conference.

Contractor Moser has been busy removing all of the equipment and other crafts are repairing holes drilled in the walls, etc., through which conduit and metal molding was run. In order to get the job in at the required time, six qualified men were put on the job by the contractor and they worked straight through Saturdays and Sundays until it was completed.

In this electrical age, even a peace conference must be adequately wired.

Photo-cell monitors door closing

Shut-Eye

Grandpa used to yell "Close the door," but at a packing plant there is no one to remind employees to close doors or refrigerator compartments, and as a result much heat enters.

One large national packing company plant in San Francisco now lets a photoelectric cell do the job if employees forget. Success with the device indicates it may be used on many more doors to refrigerated spaces.

The control has been designed to operate the opening and closing of the door in case the employee forgets. When an employee wants to go through the door with a truckful of meat or other produce, he pulls a cord which closes a door switch and establishes the photoelectric beam at the same time. As he crosses the threshold, the beam is interrupted and not re-established until he has passed completely through it. At that time a bell on the inside of the room starts to ring and a light goes on. Both light and bell continue operating until the cord on the other side of the door is pulled to close the door. If it should not be pulled, the switch is operated by the photoelectric control at the end of a seven-second lapse.

In the event a second individual goes through the door during one of these seven-second periods and interrupts the beam while the door is already open, the first beam is canceled and the second seven-second period begun to hold the door open.

The door is a product of Schoelkopf Mfg. Co., Madison, Wis., with a General Electric photoelectric control. Previous to installation, refrigerated doors often remained open as much as 75 per cent of the time, even though switches for closing were conveniently placed. The new device has also made employees more door conscious.

Recently opened in Montrose, Colo., is a new electrical shop, Montrose Electric Co., of which Ira A. Owens, formerly of Cortez, Colo., is owner. Owens plans a full electric service for local customers, including wiring, lighting, repairs, motor rewinding and appliances, as soon as they become available

● CHANGES in design will come before the long, slender type of fluorescent lamps, known either as "Slimline" or "Long-slim" are used in series circuits. First it was announced that these lamps could be used either for multiple or series operation. Since safety bases with no exposed live parts are desirable for the series operation, in order to keep the nominal length of the lamp, (one lamp plus two series sockets), to even lengths of, say, 96 and 71 in., the idea of using the multiple lamp with an adaptor on series circuits has been discarded. Instead, a new lamp suitable for use on series circuits is in the process of being developed, General Electric Lamp Department announces.

Poster Drying

Infrared saves space, time and manpower

FROM show business to show bills Floyd Bentley of Portland has moved. Operating a silk screen process by which local labelings are placed on 24-sheet posters for a number of large lithographing concerns, the Bentley Poster Print Co. has found that infrared lamps speed up the work and save a tremendous amount of space formerly used in stacking poster sheets for drying.

Originally located at 4043 N. E. 42nd St., Portland, the Bentley Poster Print Co. recently moved to larger quarters at 420 S.E. Alder St., Portland, and additional infrared equipment may soon be installed there.

The original equipment, pictured here, consists of a bank of 40 kw. in heat lamps mounted in Fostoria reflectors over a bed of a conveyor. The lamps are so wired that each two rows of the units the full length of the conveyor line can be controlled from one master switch. There are seven rows arranged in four banks and the switching is so arranged that any one bank can be switched in or out or any combination can be provided. By using three-wire circuits a single-phase switch can take out one-half of each row.

The conveyor operates on a 50-1 reduction Reeves drive and is further reduced 2-1 by V-belt. the infrared heating lamp units are adjustable to height through an ingenious arrangement. Each bank can be lifted for relamping or adjustment. Holes in a plate on the upper end of each supporting post allow for various heights for the lamps above the surface of the conveyor belt. These posts are hinged near the top so that they can be dropped down out of the way.

In its process the Bentley company often has only a small portion of paint to dry on a large sheet. Through the flexible arrangement of controls for the lamps only such units as are needed to dry such a sheet may be switched on. There is one switch of 60 amp. for each bank, or section. Below it is an eight-circuit panel, fused with fustats for protection of each of the lamp circuits. Total load is 42 kw. and is served by a 35-kw. transformer.

Before using the infrared means of drying, separate racks had to be provided for each sheet as it was processed; these racks were stacked on top of each other and required a great deal of storage space. Depending upon the humidity, it took from hours to days to dry. Consequently, the power cost is more than compensated for in the speed of production and the better utilization of space as well as the saving of labor.

REA Wiring Policy

What is REA policy in regard to wiring of rural homes and farmsteads for electric service? Answer to this question, which arises in the minds of contractors in the towns near REA systems, is given in a recent release from the Rural Electrification Administration.

"Most of the REA cooperatives are urging contractors to train men now for the jobs that will be available in the areas they serve. The contractors are assured they will be given first call for the work if they have the crews.

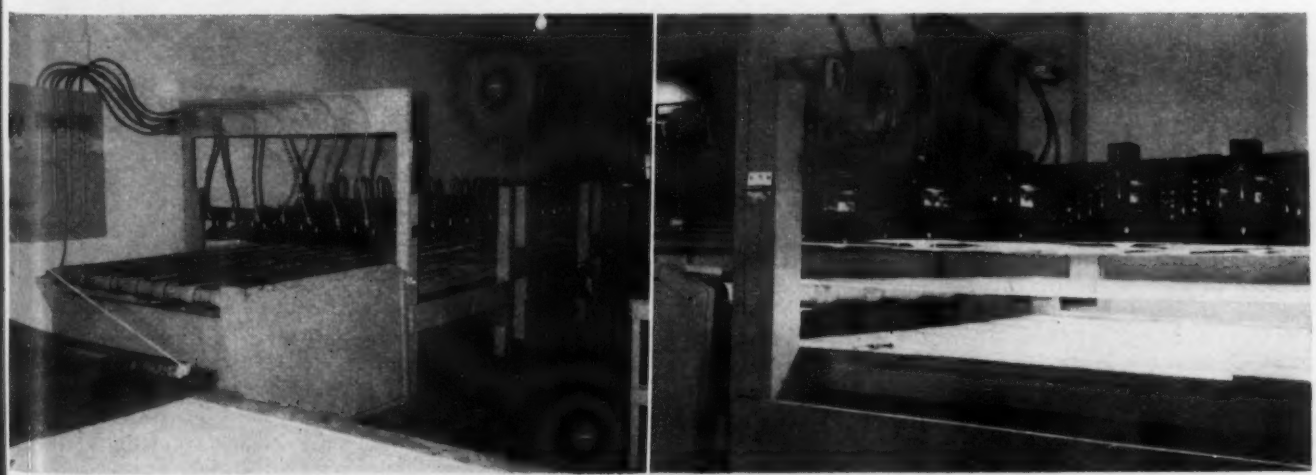
"Some cooperatives have gone so far as to announce that. if contractors do not display the initiative necessary to develop and serve this farm trade, they will seek to establish new wiremen in the community through a training program of their own. This, however, the co-ops insist they do not want to do."

Taking the position that wiring installed must be of professional quality, and that whoever does it should do it right and stand back of his work, REA prefers that electrical contractors be called in to do both the line construction and the wiring of homes and farmsteads. With a resumption of REA activity, frozen during the war, the volume of business in this direction is expected to increase materially as construction materials become available.

This policy is being recommended by the REA to its rural groups. The principal reason for the current campaign in favor of trained contractors is to reduce the number of accidents and to guarantee the rural residents a better standard of living. It maintains that the expert's wiring job not only is cheaper over a period of years, but actually will make the consumer money. Meanwhile it urges the reliable contractor to train and hire electricians, particularly men returning from the armed forces.

●PORTLAND'S electric code is under process of revision by Chief Electrical Inspector Lew W. Going. A feature of it will be quite an elaborate cross indexing system between it and the National Electrical Code. It will also contain the administration clauses and sections classifying various workmen. The indexing will be particularly valuable to the number of newcomers who have entered the electrical field in the Portland area lately. It will enable them to find the sections of particular interest to them, such as: elevators, fixtures, residential, commercial and industrial rules. Going declared that a radio technician's ordinance was also likely to be submitted soon by members of that industry.

Conveyor under four banks of infrared units in poster plant. At right, detail of hinged adjustable support is shown

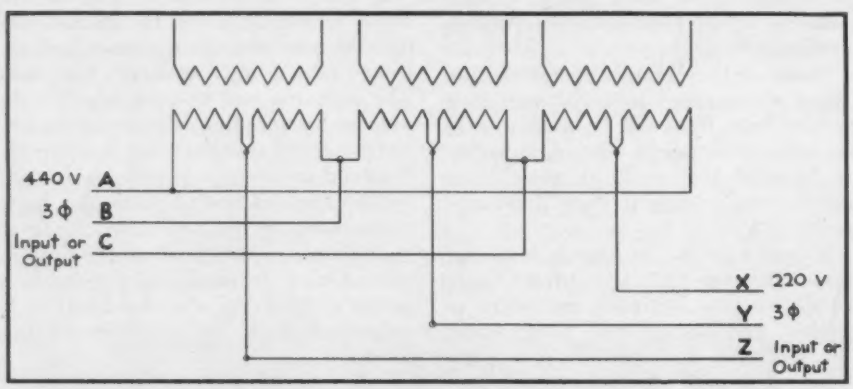


EMEA *Dope Sheet*

Practical Ideas for Maintenance Men

Makeshift transformer hook-up for emergencies: power factor check list; figuring kw. demand

IN the past several years a number of EMEA members have needed three-phase 220 volts where only 440 volts were available. Transformers were not obtainable quickly to do the job in the usual manner, so it was done quickly and easily by using idle distribution transformers as autotransformers. In each case the transformers happened to be 2200/220/440 single phase, although the primary voltage is not important as the primary windings are not used. However, the primary leads will be energized at their rated voltage, whatever that may be, and to prevent accidental contact they must be well insulated to safeguard people who might work or pass near them. The secondary windings must be 220/440, of course, and may be connected as shown in the accompanying diagram.



Three-phase 220 is obtained from 440 using a 2200/440/220 transformer

440 volts three phase may be input at A, B and C and 220 volts three phase taken out at X, Y and Z or inversely, 220 volts three phase may be input at X, Y and Z and 440 volts three phase taken out at A, B and C. The load, of course, must not exceed the ampere rating of the secondary windings.

This method is not suggested for permanent use because the installation cost is high. However, it has been used for years in some instances where the transformers would have been idle otherwise.

Do not forget the primary leads will be hot and at their rated high voltage. They must be left disconnected and well insulated to avoid accidental contact.

Power Factor Check

In surveying to make power factor corrections, the information required to determine corrective kva. applications includes the following:

1. Present load in kw. or kwh.
2. Reactive kva. or rkvah. (or kva.)
3. Present power factor.
4. Desired power factor.
5. Actual average voltage in plant or system.
6. Maximum sustained voltage for periods as long as one half hour.
7. Frequency and number of phases.
8. Rating of power transformers.
9. Location of plant:
   a. Near the end of long (power co.) feeder.
   b. Near the center of an industrial district.
10. Contemplated increase over the present load.
11. Machines, such as compressors, in the plant to which synchronous motors can be properly applied.
12. Hours per day of plant operation at normal capacity.
13. Load conditions during the 24-hour period of the day.
14. Extent of load changes during the year.
15. Approximate short-circuit current possible at the point where the power-factor correction is to be connected.
16. If power-factor correction is intended for general plant or system correction, ascertain:
    a. Load, power factor and hours of operation of all main and sub-feeders.
    b. Load, power factor and hours of operation of all motors.
17. Physical conditions restricting location of corrective equipment in system.

Determining Demand

Either kw. or hp. from disk r.p.m. of kwh. meter

It is often necessary to determine the momentary kw. or hp. demand in a system or some part of a system. The demand of added load may also be determined by the following method.

The demand may be found by counting the disk revolutions for one minute and computing by the following formula. For more accurate results, count the r.p.m. three times and average.

FORMULA

Watts demand = disk r.p.m. × disk k × transformer ratio × 60.

$$\text{Kw. demand} = \frac{\text{watts}}{1000}$$

$$\text{H.p. demand} = \frac{746}{\text{watts}}$$

H.p. demand = kw. × 1.3405

EXAMPLE

Disk r.p.m. = 34.
Disk k = 2.4.
Current transformer ratio: 50 to 1.

SOLUTION

Watts demand = 34 × 2.4 × 50 × 60
= 244,800 w.
Kw. demand = 244.8 kw.
H.p. demand = 244.8 × 1.3405
= 328.15 h.p.

The disk k will be found on disk or name plate. The disk k represents the number of watt hours for one revolution of the disk.

If potential transformers are also used to reduce the voltage of circuit metered, the product must be multiplied by the transformer ratio also; i.e.: 110-volt meter on 440-volt circuit, multiply by 4.

● ACKNOWLEDGMENT — These ideas, like many of the previous EMEA Dope Sheet pages, came from the EMEA of Southern California.

Light for Turkeys

Egg production tests show required intensities

FURTHER tests to determine the effect of lighting upon the egg production of bronze turkey hens have been conducted by V. S. Asmundsen of the division of poultry husbandry and Ben D. Moses of the division of agricultural engineering of the U. C. College of Agriculture. The tests, sponsored by the California CREA, showed in 1943-44 that turkey hens required a minimum of 2 ft.-candles to bring them into egg production in the shortest possible time. Because brighter lights were not used, it was deemed desirable to repeat the tests of preceding years to see if the birds responded more quickly to brighter lights and also to confirm previous results.

Six pens of 10 birds were selected which were comparable as to strain and age (with the exception of one hen in each pen). Nearly all of the birds were hatched between April 26 and May 10, 1944, and were, therefore, about 7 months old when the lights were turned on Dec. 1. Data for the tests are shown in Table I.

While the birds in pen No. 35 started laying a few days earlier than those in pen No. 36, the difference is not statistically significant. It may be concluded from the tests that about 2 ft.-candles of lighting intensity is sufficient to produce maximum results.

Table I—Effect of Light on Egg Production of Turkey Hens, 1944-45

Pen No.	35	36	37	38	39	40
Light used, watts	200	100	60	25	10	0
Light intensity in foot-candles 2 feet above floor	10.4	4.4	1.8	.56	.18	..
Same, at wall	4.2	1.9	0.9	.27	.09	..
Date of first egg	12/16	12/28	12/26	1/27	1/8	2/28
Average date of first egg (8 or 9 birds)	12/31	1/4	1/13	2/21	2/27	3/18
Average per cent egg production:						
December, 1944	4.5	3.2	..	..	..	..
January, 1945	59.7	59.7	28.4	0.3	6.8	..
February, 1945	56.8	50.3	33.6	14.6	4.6	0.4
March, 1945	40.6	49.1	40.3	40.3	26.8	23.9
April, 1945	40.3	35.5	35.6	41.0	37.0	39.6
May, 1945	42.9	29.4	18.1	19.3	24.2	24.2
Total average number of eggs per hen from December to May, inclusive	73.8	68.0	47.0	35.0	30.3	26.9

Several other conclusions can be drawn from the tests. Lights do not eliminate all differences in sexual maturity. Birds brought into production early by use of lights lay just as well in April and May as unlighted birds. Lights of less than 2 ft.-candles intensity produce a slower response (pens 37 and 38 or no response (pen 39). The difference in pen 39 and 40 was due to one early maturing hen in pen 39.

The test agrees with results of earlier experiments and furnishes sufficient information to answer the question as to the intensity of light to obtain maximum results from a 13-hour day. Dr. Asmundson recommends that further work should be done to determine the maximum and optimum length of day.

● PLANS and specifications for three different sizes of farm type freezers prepared by the Agricultural Extension Service and the Division of Agricultural Engineering, U. C. College of Agriculture in cooperation with the California CREA, are ready for distribution to California farmers and others interested in this subject. They are part of the extension service farm buildings and equipment plan series. The plans cover a 12-, a 21- and a 30-cu. ft. capacity freezer of the chest or top opening type, which can be constructed on the farm or by a local mill or carpenter. They are prepared by J. R. Tavernetti after an experimental freezer which was thoroughly tested by the Agricultural Engineering Division at Davis. Information regarding the plans can be secured from the Public Service Office, Agricultural Extension Service, 108 Giannini Hall, University of California, Berkeley 4, Calif.

● A 56-PAGE BOOKLET on farm wiring has been published by General Electric Co. Wiring layouts are given for entire farms, with number of circuits required for each building and recommendations for placing outlets and switches. Sample floor plans indicate where wiring should be installed for best results. Blank graph pages can be used for making special wiring layouts.

An electric poultry picker, employing a revolving drum with corrugated rubber fingers, conserves manpower on the ranch of H. C. Burkholder, Arcadia, Calif. At top speed, the machine will pick clean 200 fowls per hour and, according to Burkholder, two men and the electric picker can turn out more work per hour than 40 men picking by hand. At left, workers wash fowls in preparation for the machine; right, a scalded chicken is held against flexible rubber fingers of rapidly revolving drum. An electric fly killer helps maintain sanitary conditions

ELECTRICAL WEST

McGRAW-HILL COMPANY OF CALIFORNIA
68 POST ST. SAN FRANCISCO 4

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Future Government Power

A RATIONAL basis for integrating future federal power developments into the over-all electric power set-up of the U.S. has been proposed by a group of 167 operating companies. A statement of policy has been issued by the group that should form the basis for extensive future cooperation with government instead of the internecine warfare that has existed in the past.

If the regional authority philosophy of river development is to be the chosen instrument for the future, then these companies offer a plan whereby the power phases of these projects can be implemented with maximum benefits to the public. The suggested program of cooperation involves four points: (1) That the government define clearly in enabling legislation all of the purposes—flood control, navigation, irrigation or power—for which the dams are being constructed, and justify in their costs the benefits to the people in the region served. (2) That the federal government sell power from river authority dams to existing systems without special privilege or discrimination, and thus avoid expensive duplication of existing facilities and help coordinate regional power supply and assure widest possible use at the lowest possible rates. (3) That the distributing organizations pass on to electric customers all savings from the regional authorities, under regulation by state commissions or other agencies. (4) That the government accept the policy that it "may properly regulate business, but it should not operate business."

Some such policy agreement as this is vital to the welfare of the companies. Under the pressure of wartime emergencies, this kind of cooperation has existed in the operation of the various power pools. It should be extended into the future.

System Rehabilitation

AS V-J day draws ever nearer, utility engineers are turning their attention more and more to problems of system rehabilitation. The field is large and opportunities for improvements great. Entirely apart and aside from the overworked and overloaded distribution facilities which constitute most of the so-called backlog of deferred maintenance, there are many other points on the systems where work must be done. Included in this category is the modernizing of oil circuit breakers to meet the demand for higher speeds, the reinsulating of generators and condensers, the modernizing of switchgear, and the installation of telemetering and supervisory control equipment in many substations to improve the quality of service. Such improvements constitute a sizeable backlog of postwar employment and business.

One California company has an approved program for system-wide modernization of circuit breakers in the field with manufacturer's parts. This type of improvement is made possible by the rapid advancement in the circuit breaker art in recent years and will provide the higher interrupting capacities and speeds required by system growth and pooled operation. Other utilities are planning to do likewise.

Need for reinsulating major rotating equipment fortunately comes at a time when full advantage may be taken of recent developments in insulating materials. Fiber glass insulations, silicones and other developments now permit the replacement of class A insulation in older machines with class B with an appreciable increase in machine rating because of the higher operating temperatures possible. One utility is already reinsulating some of its large hydro generators and another company has a comprehensive program in the making.

Extensive pooled operation of systems, a technique ushered in by the war, is here to stay because of the multiple benefits involved. These operations demand centralized system control, including telemetering and tie-line load and supervisory control. So far not much has been done to provide these refinements. However, as evidence of a trend, one large company is now surveying its entire system for a supervisory control arrangement which will centralize in one major substation operation of all

substations over a wide area. This is a significant development which promises to be adopted widely.

All of these refinements point up a characteristic for which Western power companies have long been noted—a forward looking attitude based upon a policy of rendering the best possible service at the lowest possible cost.

Dealer Relations Men

HOW to hold good men, versed in policy and experienced in selling, as dealer relations or contact men when the utility has ceased to merchandise is a question that many a sales manager has worried about in these days of change and planning. As salesmen, these men may have had an opportunity to earn considerable above their base pay in commissions or bonuses. To settle down to base pay alone is so unattractive to many good men that they leave the utility and seek employment elsewhere and the years invested in training in policy, tact, company procedure and detail go out the door with them.

The dealer relations man of a non-merchandising power company should be on basis comparable to that of the distributor man who calls on dealers also. But how to accomplish this when the distributor's man gets a drawing account and a commission? Certainly something near what the distributor's man averages in earnings might be computed for these men.

Since the dealer representative in many ways must be the equivalent of a sales manager for a large number of volunteer salesmen of varying and often conflicting interests, it takes genuine skill, tact, organization ability and selling persuasiveness, in addition to company rate and policy knowledge, for his job. Such a man deserves a better rating than even a good appliance salesman. Only by providing it will utility companies retain such high-grade men.

Power Factor Correction

LIKE the sins of the fathers which are visited upon the children, the sins of omission in respect to power factor now threaten to visit grief upon the industry. So many things could have been done long ago which would have prevented the increase of poor power factor. They were relatively unimportant at the time; possibly entailed additional small expense. There was not enough equipment of lagging power factor to make the serving of it much of a headache then.

Years ago one motor manufacturer spent a lot of money advertising and advocating power-factor corrected motors. He was alone. The problem was not acute and nothing was done about it. Years ago too some engineers advocated ampere-hour meters instead of watt-hour meters. They cost more but might not have, produced in large quantities. Inductive load would pay its full way as it passed through such meters. Now it is too late to cry over that spilt milk.

Motor loads alone, except in factories, where power factor rates apply, caused no serious concern. It was the advent of fluorescent lighting, with its inductive ballast, that made correction of lagging power factor important. By strenuous effort, both in utility commission rules and in persuasion of the manufacturers, commercial and industrial lighting equipment virtually all is equipped with capacitor correction auxiliaries.

The bugaboo rises again in contemplation of extensive use of fluorescent lighting in the home. Makers of home fixtures are so numerous and so often moved by price competition to make the cheapest possible stuff, that it may be difficult to get power factor corrected ballasts incorporated in these devices. One manufacturer has suggested a leading power factor ballast for the new circular lamps, as an aid to balancing the good and bad in the average house. Possibly that is the most practical compromise.

THE consumer is boss. Only through the purchases of millions of customers can maximum production, low-cost distribution and consequent high-level employment be maintained. This all adds up to Americanism.—George S. Jones, Jr., vice-president, Servel, Inc. . . . *We can make it—are we equally sure that we can sell it? If high-level employment is to be sustained, our distribution machinery will have to be overhauled, thoroughly lubricated, modernized and streamlined. Creative salesmanship will have to be revitalized and selling will take on a new meaning.*—James W. Dunaway, vice-president, Lees-Cochrane Co., Inc. . . . *Industry must do a tremendous selling job to maintain jobs. Jobs come only through selling the products of jobs. For the safety of America as a whole and for the safety of your own business, you have ahead of you the biggest selling job that has ever been known. The potentials are there, but the customer is and will be the boss. He has got to be sold. After five years of a sellers' market it is not going to be easy. But it has got to be done and the opportunity to do it is there. A mental reconversion is necessary—reconversion to selling.* —Everett R. Smith, research director, McFadden Publications.

NWEL&PA Gets Set for New Tasks Ahead

New administration elected; accountants hold their conference; industrial development group has meeting

AMID renewed enthusiasm for possibilities of service extension to farms, and eventual resumption of electrical business in all fields after the Jap war, the 38th Annual Meeting of the Northwest Electric Light & Power Assn., at Portland, July 18, elected Pat Johnson, Puget Sound Power & Light Co., Seattle, president. At the same time, the association went on record commending the administration of the retiring president, J. A. Hale, Utah Power & Light Co., Salt Lake City, who had directed the association's affairs during the past two critical war years. T. E. Roach, Northwestern Electric Co., Portland, was elected vice-president.

The meeting heartily endorsed the project started by Hale of issuing a rural electrification booklet, telling of the accomplishments of the business-managed electric utility companies in the area, in cooperation with state colleges and others, and pointing to the future development in this field, by which these companies expect to serve an additional 25,000 rural customers during the next few years. This booklet, when issued, will tell the story of the many benefits electricity has brought to agriculture in this region, and will be distributed in quantity to public officials, farm customers and prospects, and organizations interested in agriculture and electrification.

The meeting also endorsed in principle the idea of establishing an Industrial Service by the electric companies of the Pacific Northwest, with the details to be worked out by the incoming executive committee.

Other officers elected at the meeting were: vice-president for Idaho, C. J. Strike, Idaho Power Co., Boise; vice-president for Montana, S. P. Hogan, Montana Power Co., Butte; vice-president for Oregon, George T. Bragg, Pacific Power & Light Co., Portland; vice-president for Utah, W. A. Huckins, Utah Power & Light Co., Salt Lake City; vice-president for Washington, W. L. Thrailkill, Washington Water Power Co., Spokane; vice-president for British Columbia, W. C. Mainwaring, B. C. Electric Railway Co., Vancouver, B. C.

Provision was made for the first time at this meeting for representation on the association's executive committee by electrical contractors and appliance dealers. R. D. Horning, Seattle Electrical Contractors Assn., Seattle, was elected to represent the former, and Carl Edstrom, E.N.E. Appliance Co., Portland, to represent the latter. Manufacturer and jobber representatives on the committee were elected in the persons of J. C. Platt, Edison G. E. Appliance Co., Seattle, and W. M. Jewell, Westinghouse Electric Supply Co., Seattle. Utility company representatives were John C. Boyle, California Oregon Power Co., Medford, and George E. Sullivan, Portland General Electric Co., Portland.

President Johnson completed the roll of association officers by appointing J. E. Anderson, Puget Sound Power & Light Co., Seattle, as treasurer, and Berkeley Snow, Portland, executive secretary. He also appointed the following section chairmen: Accounting & Business Practice, C. R. Groth, Pacific Power & Light Co., Portland; Business Development, J. M. McKay, Portland General Electric Co., Portland; Engineering and Operation, R. J. Davidson, Pacific Power & Light Co., Portland; Personnel, R. H. Sessions, Idaho Power Co., Boise. The Personnel Section is newly created this year from the Personnel Conference, which has been functioning for the past two years. "Business Development" was adopted as the new name for the former "Utilization" Section, thus re-establishing its prewar name and suggesting its activities for the future.

Johnson also announced that the association's over-all planning committee, known as the Electrical Development Committee, will be headed by Daryl B. Leonard, Pacific Power & Light Co., Yakima, Wash., a position held by Johnson the past two years. He stated it as his intention to call the new executive committee together within the next month and a half, so that an early start can be had on the many important affairs the association proposes to undertake this year.

UTILITY company accountants are becoming more and more a definite part of management, C. J. Strike, president of the Idaho Power Co., told the group gathered at the annual conference of the Accounting and Business Practice Section of Northwest Electric Light & Power Assn. at Boise, June 12-13, 1945. As such, the accountants have a responsibility for helping to get the utility story across to the public, Strike continued.

In our original cost studies, we have unscrambled the basket and found what was in it, and we are now building on a new foundation, Strike said. Our accountants know this story and can help tell it, in a way that will offset the contentions of those who want to take us apart. I do not believe the people will want to socialize our industry when they know the facts that the accountants produce in the course of their studies of our structures.

The meeting was called by J. H. Rogers, Idaho Power Co., chairman of the section, and drew an attendance of 35 representatives of the association's utility company membership. Customers Accounting and Collections, with Henry Mann, Utah Power & Light Co., discussion leader, drew forth a detailed discussion of processes and practices of the various companies on meter reading, billing and collecting. Reading and billing on other than a monthly basis appeared to all but one company to be a temporary wartime procedure. Puget Sound Power & Light Co., on the other hand, found bi-monthly reading and billing an economy it expects now to retain. All reported that delinquents are now at a very low level, but the companies agreed that, in the postwar period, strict collection policy will be needed.

J. E. Winton, Washington Water Power Co., had made a study of district office procedures and found many opportunities to streamline and short-cut work, and thus cut the manpower and hours used to carry on this routine.

R. H. Sessions, Idaho Power Co., advocated that persons in the personnel field hold interviews with employees to determine capabilities and ambitions of those employees so that they could be properly placed as advancement opportunities arose. Training programs should take the form of specific job training; employees are showing increased interest in hospital plans, sick leave, pensions and recreational facilities, and management should give thought to how much can be spent on such employee benefits; employment policies should contemplate upgrading employees who have been in jobs for many years, or helping them find better jobs outside; these were some of the ideas advanced by Sessions.

Discussion of this subject, under the leadership of R. W. Petersen, Puget Sound Power & Light Co., brought out that the companies would probably be forced to a shorter week after the war, perhaps before the war ends. Local labor areas were favored over large labor market areas, so that rates of pay could conform to local conditions. Belief was expressed that WLB would go out of business after the war, and that this would leave only the unions to deal with in matters of wages, hours and working conditions.

In the discussion of plant account

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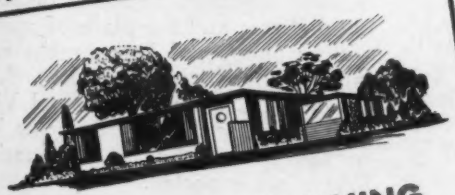

POSTWAR PLANNING

T. F. Flynn, Pres. of The Flynn Electric Co., electrical contractors, Bridgeport, Conn. says, "Postwar planning for the average American home should include adequate wiring. This is made necessary due to developments in home appliances, freezers, driers, blankets, air conditioning and heating equipment."

ADEQUATE WIRING SERVES AND SAVES — THE KEY TO THE HOME OF TOMORROW

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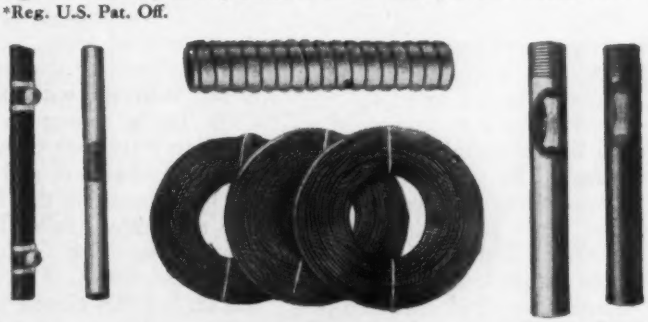

GENERAL ELECTRIC

Hear the G-E radio programs: "The G-E All-Girl Orchestra," Sunday 10 p.m. EWT, NBC; "The World Today" news, Mon. through Fri. 6:45 p.m. EWT, CBS: "The G-E House Party," Mon. through Fri. 4:00 p.m. EWT, CBS.

ing, as led by R. W. Lawlor, Northwestern Electric Co., a simplified work order system, designed to relieve the foreman of numerous accounting details, was explained by J. H. Wiley, Idaho Power Co. The system contemplates a peg board method of accumulating material items and the spreading of the total hours of labor on these jobs for one month over the proper accounts, on the basis of the hours estimated for each account as accumulated also by the peg board method from the work order estimates. This system, it is claimed, has prevented abnormal charges from getting into plant and reserve, has provided better control of the plant account, and has relieved foremen of burdensome accounting on the job.

A new pay roll procedure used in the Idaho Power Co. was explained by V. T. Montgomery of that company. The procedure involves the use of average man-hour rates for outside employees, and the utilization of the peg board instead of the laborious hand system of accumulation. It has reduced the cost of preparing pay roll account distribution by 75%.

The new Classification of Accounts Committee of the association has received five questions of interpretation on borderline cases, and has answered four, according to C. R. Groth, Pacific Power & Light Co., chairman of the committee. The committee receives questions submitted by member companies, and writes its single opinion, if agreement among committee members on interpretation is obtained, or submits varying opinions as the case may be.

INDUSTRIAL development programs of the member utility companies of the Northwest Electric Light & Power Assn. were reviewed at a meeting of the association's Industrial Development Committee in Seattle, June 20. C. T. Bakeman, Puget Sound Power & Light Co., chairman of the committee, presided.

O. C. Mayer, Idaho Power Co., stated that his company was emphasizing small 5- to 25-man industrial enterprises, and was including in the program, opportunities for commercial expansion in the communities served by the company. The company had assisted in community surveys which indicated the types of businesses that could be established, and had done considerable research for small industries. These surveys had indicated possibilities for starch manufacture, the quick freezing of Idaho fruit, the fertilizer industry, and certain wholesale and retail opportunities in different lines. This type of program appealed to the businessmen in the smaller communities served, Mayer stated.

Among the activities in the Inland Empire area around Spokane, as portrayed by L. V. Ross, Washington Water Power Co., were assistance to the state college in securing funds for setting up an industrial research division. Need was also found for coordination of all agencies entering into industrial and market research, and the company took the leadership in organizing an Industrial Advisory Council, consisting of representatives from the railroads, Chambers of Commerce, the Bonneville Power Administration, and certain large industries. The company was carrying on a continuing research to attempt to measure the sizes of the job to be done in absorbing the labor to be released from war industry.

E. C. Branch, Puget Sound Power & Light Co., explained the kind of a survey conducted in Bellingham, Wash., in which the company took the leadership in getting the Chamber of Commerce to organize group action with 14 sub-committees working on different parts of the survey under an overall committee. This survey, which has been a year in the making, will set forth analysis of all factors entering into industrial development for that community. Results are to be published in a booklet now in the hands of the printer, consisting of 54 pages in 3 colors; issue will be 10,000 copies.

At the end of the meeting, C. T. Bakeman, chairman, appointed several sub-committees to investigate various projects suggested for future joint action of the Industrial Development Committee.

RMEL on Wiring

Rocky Mountain Electrical League members had their first opportunity to see and hear Edward S. Northup, new field representative of the National Adequate Wiring Bureau, July 11-12, in Denver. They were impressed by his realistic approach to the problem through intensive and extensive educational programs, rather than by the application of some "magic formula." Northup's advice that RMEL establish closer contacts with finance institutions (as a means to discover new building activities) as well as cultivate architects, builders and electrical contractors, inspired the league's executive committee, July 20, to authorize employment of a field man qualified for such duties. For several years, RMEL has functioned without an outside man to promote adequate wiring through suitable channels; but a sufficient relaxation of priorities on essential electrical materials has provided a springboard from which an aggressive campaign can now be launched successfully, the committee believes.

Inspectors' Plans

Instead of the usual annual meeting of the entire Southwestern Section, International Association of Electrical Inspectors, this year, because of restrictions on transportation, the section will hold two one-day meetings Oct. 1 and 3, in San Francisco and Los Angeles, respectively, it was announced by H. L. Gerber, secretary of the section. The two meetings will be accessible to members within a local transportation radius of each city without need for hotel accommodations or train travel. The necessary business of the association can be conducted, elections held, and a condensed summary of the most vital National Electrical Code changes can be had from these sessions.

Ordinarily, because E. E. Larson, Riverside electrical inspector, is president this year, the annual meeting would have been held in southern California. Indeed plans to hold it at the famous Mission Inn at Riverside had been worked upon. Instead of cancelling the meeting entirely, because of the importance of the pending changes to the National Electrical Code, the executive committee of the section decided upon the two local meetings.

They will be held as Northern California and Southern California Chapter meetings, attended by all members of all other chapters adjacent to them. No entertainment or social features are planned, the brief one-day session being for business and Code only.

A nominating committee has been appointed by President Larson and its report will be read and acted upon at both meetings. Further details of the program and the place of meeting will be announced later by the secretary. The national president, L. P. Dendel of Lansing, Mich., and Victor H. Tousley, secretary, may come West for the meetings but no other national figures are expected.

Puget Sound Chapter, International Association of Electrical Inspectors, presented a charter to the Tacoma division of the chapter, newly formed, at the last quarterly meeting, held in Tacoma in July. Harry Hilpert, state electrical inspector, discussed the proposed National Electrical Code revisions as presented by the various article committees. Next meeting will be held at Everett, Wash., Sept. 8.

Rocky Mountain Chapter, International Association of Electrical Inspectors, has recessed meetings for the summer but will meet Sept. 25, at the city and county building, Denver, for study of Article 300 of the National Electrical Code.

Frozen Foods, a moving picture, was presented by General Electric Co. to the Electric Club of San Diego at its Ladies Day, in June. Archie Marsden was chairman of the day.

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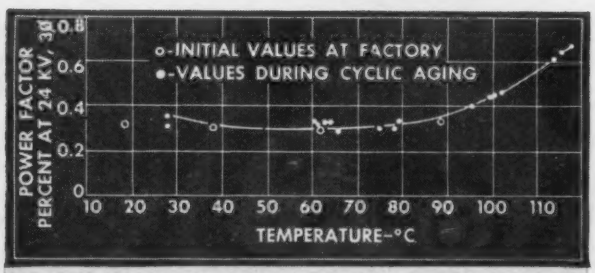

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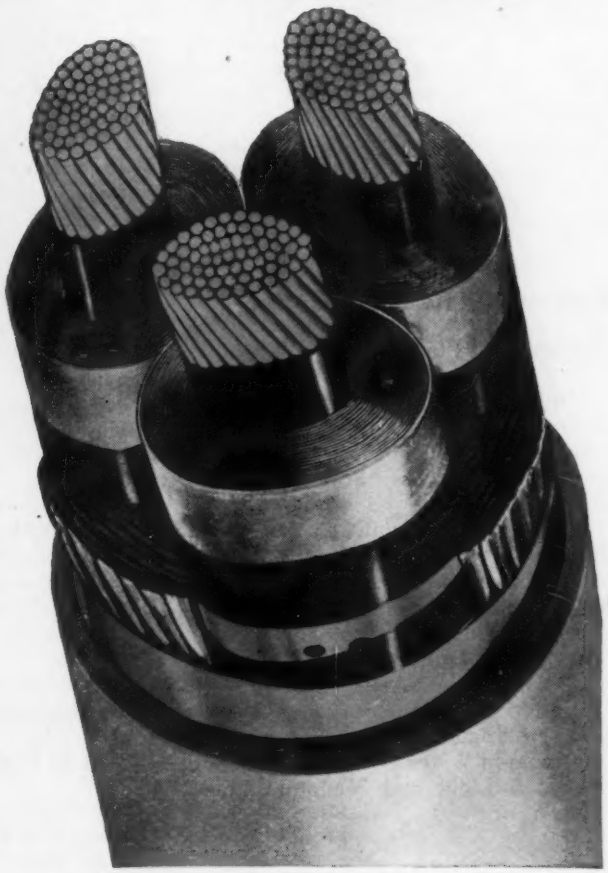

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NEWS of the industry

UTILITIES SALE DENIED BY COMPANY OFFICIALS

Rumors that northwest utilities were being sold by American Power & Light Co. in a deal with Guy C. Myers, Wall Street promoter and Washington PUD fiscal agent, were denied last month by both power company officials and Myers.

Kinsey Robinson, president of Washington Water Power, and Paul B. McKee, Pacific Power & Light Co. president, stated that their properties were not for sale. Myers asserted that no purchase negotiations then existed, though he was quoted as stating that they would soon be started.

Meanwhile prospects for a special election in the City of Spokane were seen in a statement of Mayor Otto A. Dirkes that the city undoubtedly would have to choose between association with a PUD or a municipally owned and operated system for its electric power. Dirkes said he believed that Washington Water Power properties in the eastern section of the state would be sold and that city commissioners were investigating municipal power.

Bonneville Rate Changes Subject of FPC Hearing

Protests of five Pacific Northwest power companies will result in an FPC hearing at Spokane Aug. 14, on proposed changes in Bonneville rate schedules.

The companies contend that certain provisions of the proposed schedules would discriminate against utilities which own and operate facilities for generating substantial amounts of their own energy requirements, in favor of public bodies and cooperatives.

Protesting companies were Pacific Power & Light, Northwestern Electric, Washington Water Power, Puget Sound Power & Light and Mountain States Power.

● GERALD L. SCHLESSMAN, former Denver investment broker who has budded into an electric utilities tycoon by acquiring properties subject to divorcement from holding companies, recently announced purchase of two new plants and distribution systems in Colorado. One is the Sheridan County (Wyo.) Electric Co., a Federal Light and Traction property, for a consideration of $641,015. The other is Shickley Electric Co. whose system is nearby and will be integrated with that of the Sheridan County by means of a highline connection extending from Clearmont (Wyo.) to Ucross (Wyo.). Shickley Electric was owned by private parties and the transaction is not subject to SEC approval.

Hetch Hetchy Disposal Now Conforming With Raker Act

Ending a ten-year controversy over city conformance with the Raker Act, San Francisco last month agreed to changes in its Hetch Hetchy power disposal contract (EWEST, June and July) to make it acceptable to Secretary of the Interior Ickes. City officials took the five-year contracts to federal court July 2, prepared to fight for approval over Ickes' objections, but later worked out a compromise.

Main objection raised by Ickes was with regard to sale to Pacific Gas and Electric Co. of energy replaced by Hetch Hetchy power. Turlock and Modesto Irrigation districts, two of the customers under the contract, have been selling power generated at their own plants to PG and E and it was anticipated that these sales might be increased following purchase of Hetch Hetchy power. The revised clause in the contract provides that the districts will sell to PG and E none of their own power produced at Don Pedro Dam, which may be replaced by Hetch Hetchy power.

Other city customers under the contract are the Kaiser Co. and Aluminum Co. of America. Pending construction of a 23-mile tie-line with the irrigation districts, the city will continue using Hetch Hetchy power for municipal purposes.

PUD Sympathizers Ask Court Action in Franchise Bid

Court proceedings have been instituted at The Dalles, Ore., to force the city to accept initiative petitions and call a special election on the North Wasco County PUD franchise proposal. The council had thrown out the petitions on the grounds that they did not comply with legal requirements.

Petitions were circulated following city council refusal to grant the PUD a franchise to build competing lines in the town, now served by Pacific Power & Light Co. The refusal was the third rejection of a PUD franchise proposal at The Dalles.

FPC ALLOCATES COSTS OF BONNEVILLE DEVELOPMENT

Basing its decision on wording of the Bonneville Act, FPC last month made final cost allocations for the development, charging power with approximately one-half the joint navigation and power facilities.

Allocated to power revenues are $86,128,370 of the $112,034,352 capital investment, including the $37,681,648 invested for power; the $28,324,922 cost of transmission facilities constructed under the Bonneville Act, and $20,121,800 of the $40,243,727 investment in facilities used jointly by power and navigation.

In a dissenting opinion, Commissioner Nelson Lee Smith stated that power should bear 85% of the joint costs. Power had been charged with about one-third joint costs in preliminary allocations, made in February 1938 and designed to facilitate plans for marketing power from the first two generating units.

The commission order was based on a report of its chief engineer, who pointed out that, under the Bonneville Act, all other purposes of the development are incidental to navigation and that no more than 50% of joint facilities should be charged to power. The commission stated that "parity in importance of low-cost transportation and power in development of the resources of the Pacific Northwest" was recognized, and that indications were that existing Bonneville rates will provide a reasonable margin over costs.

In a 36-page dissenting opinion, Smith termed as "strained and unwarranted construction", the interpretation placed upon the statute and declared that estimates on benefits to navigation had been exaggerated.

D. L. Marlett, assistant Bonneville administrator, was quoted as stating that the FPC action would not jeopardize the present $17.50 rate for Bonneville power, and that the most important part of the decision was its formal action in declaring that Bonneville can pay off its entire power debt in 50 years at 2½% interest.

● BECAUSE it was found that a PUD could not offer rates below those of the private utility serving the area, the Juntura-Drewsey Electric Assn., Vale, Ore., dropped plans to form a PUD and Idaho Power Co. will serve the load. An allocation of $492,000 to construct power lines under REA supervision had been made.

No gathering or matching of parts . . . the type EA fuse cutout is packaged complete ...ready to install...as a unit. Available in 50 and 100 ampere ratings, 5 and 7.5 kv.

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Type EA fuse cutout cartons can be stored on your service trucks with the assurance that when your trucks get on location your men have everything they need. The type EA cutout package eliminates separate storage of brackets—for any type of crossarm mounting—and greatly simplifies accounting and inventory.

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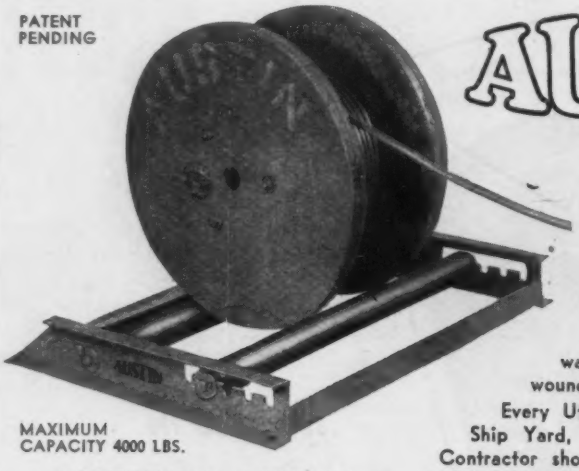

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H. H. Van Luven, 307 E. 3rd St., Los Angeles
Albert S. Knight, 3006 Western Ave., Seattle

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Write for Bulletin No. 6

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B. C. GOVERNMENT ACQUIRES PRIVATE POWER COMPANIES

Government acquisition of three British Columbia power companies was announced last month by Premier John Hart, who stated that the B. C. Power Commission would take over their operation about Aug. 1. At the same time plans were going forward for the initial step in a government hydro-electric development on the Campbell River near Elk Falls.

The properties taken over are West Canadian Hydro-Electric Corp. and its subsidiaries, Hope Utilities, Alert Bay Utilities and Quesnel Light & Water Co.; Nanaimo-Duncan Utilities Ltd., and Columbia Power Co. Ltd., with its subsidiary Columbia-Vanderhoof Power Co.

Following report of G. H. Acres & Co., engineering firm, on potential power sites, survey crews went to work at the Campbell River site. Indications are that final development there would be 200,000 hp., with initial development of 50,000 hp. The first dam would be above Elk Falls at Moose Falls, with a reservoir backing up the water to Forbes Landing and Lower Campbell Lake. Power house site would be half a mile downstream from Moose Falls, below the foot of the main Elk Falls. Head obtainable would be based on a perpendicular drop of 600 ft.

Another canyon on Campbell River, 20 miles further inland, provides a site for future development. Plans contemplate use of the Campbell River water the second and even the third time for power generation.

Pending completion of the government development, the B. C. Commission will negotiate with the Vancouver Island Power Co., Victoria, for power, Hart stated. Eventual plans of the government, he said, envisage a complete electrical development for Vancouver Island, with all privately owned distribution systems north of Victoria owned and operated by the commission and supplied from a single hydroelectric plant.

The power commission, headed by S. R. Weston, was appointed last April following approval by the legislature. In a report recommending acquisition of the private companies, the commission stated that such a move would enable it to: Establish its general operations on a sound business basis; take into its organization the experienced operation personnel of the companies; investigate thoroughly the rates and conditions of service with a view to revision; fit the properties into the general program; make the necessary services and reconstructions required for extensions to adjacent rural areas; proceed with assurance with the general program of development.

For easier Sales and lasting Customer Satisfaction ..CERTIFIED BALLASTS

It's a fact! Your fixtures will have extra sales appeal for your customers . . . *when you use Certified Ballasts.*

And good reason for this preference too, because:

1. **Certified Ballasts are built** to definite specifications . . . to assure better lamp performance. *Leading fluorescent tube makers recognize this*—since with Certified Ballasts in a fixture, they will guarantee lamp performance.
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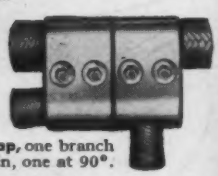
You'll find the widest variety of parallel and 90° taps, combinations, and gutter taps—in a range of sizes up to 1,000,000 cm. Insulating Bakelite covers can be furnished for all types.

Single 90° Tap from main conductor.



Combination Tap, one branch parallel to main, one at 90°.

2-Way Gutter Tap.

Bakelite Covers can be furnished for all types of Penn-Union cable taps.

3-Way; continuous main and two separate branches.

Also a complete line of Service Connectors, Terminals, Tees, Straight and Parallel Connectors, Grounding Connectors, etc. — every good type of conductor fitting. And every one is accurately made, thoroughly tested — *dependable.*

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REDDING SIGNS POWER CONTRACT WITH PG & E

A five-year power contract, under which Pacific Gas and Electric Co. will sell power at wholesale to the city of Redding, was signed last month. The city recently rejected a contract offer by the Bureau of Reclamation to furnish Shasta power for distribution over the municipal lines.

The contract with PG and E will effect a 13.9% reduction in cost of power to the city, amounting to approximately $20,000 annually. Annual savings of $53,400 would have resulted from the proposed USBR contract, but city councilmen objected to a provision that the savings must be passed on to consumers in the form of rate reductions rather than be put into the general fund.

A citizen's committee was reported planning to ask for a referendum election on the power contract.

Roseville Accepts USBR Contract for Shasta Power

In Roseville, Calif. city councilmen accepted the USBR power contract, turned down Pacific Gas and Electric's bid, and thus became the first municipality to contract for Central Valley power. The town signed a ten-year agreement with the bureau, which has offered contracts to several northern and central California communities, with the proviso that savings be passed on to electric consumers in lower rates.

At month's end, Lodi, Calif. was still considering contract offers of the bureau and Pacific Gas and Electric Co. Both offers were under the $100,000 the town spent for power last year, the bureau reducion amounting to nearly $41,000; PG and E's to about $10,000.

OWU Authorizes Generating Units for Grand Coulee

OWU has authorized without rating construction of hydroelectric turbogenerators to replace the two Shasta units now installed at Grand Coulee.

Depending on load conditions experienced by the Bonneville Power Administration, which markets Grand Coulee output, one 108,000-kw. machine may be installed in the right Coulee power house, in which there are as yet no units. Thereafter, the two 75,000-kw. Shasta machines would be replaced, or the Shasta machines might be removed and three 108,000-kw. machines installed to complete the left power house.

The borrowed machines are to be removed and installed at Shasta, whence they were diverted early in the war when it became apparent that Shasta would not have sufficient water to start generation before the middle of 1944. The two Shasta units were installed in three Grand Coulee "holes," at the suggestion of J. A. Krug, then chief of WPB's Power Division, to augment Coulee's output without the necessity or delay of fabricating additional Coulee units. At Shasta they will be the third and fourth of five 75,000-kw. units.

Shasta Steam Plant Funds Lopped Off Appropriation

A conference report lopping off funds for construction of a steam plant and transmission line network for Shasta Dam and adjusting other differences on the $111,690,258 Interior Department appropriation bill for 1946 was accepted by House and Senate and sent to the president. Public power proponents, however, stated they would insist at the next opportunity on appropriation of funds for the Shasta improvements.

As sent to the White House, the bill represented a slash of $32,148,889 from budget bureau estimates for the department in fiscal 1946 and a reduction of about $21,500,000 from the amount of the bill as passed by the Senate. It was $10,447,630 larger than the bill as passed by the House.

Junked by the conference committee was a Senate amendment which would have prevented the House from specifying that unexpended funds available to the Interior Department not be used for construction for which specific appropriations had been refused by the House. The amendment grew out of the fight over Interior's construction of the Shasta-Oroville transmission line, after the House refused funds for it.

● INCREASED STREETCAR TRAFFIC has caused the B.C. Electric Railway Co. to place two new railway power substations in operation in the Greater Vancouver area at the cost of $150,000. A 1,000-kw. unit has been installed beside the interurban trackage at the foot of Oak Street, Vancouver, while a 500-kw. station has been erected between the Lulu Island and Blundell stations. The new stations will automatically convert alternating current to direct current.

● A 14% RATE CUT will be put into effect in Oregon and Washington by Pacific Power & Light Co. Effective Aug. 22, the new schedules will save customers of the company about $1,000,000 annually, $400,000 in Oregon and $600,000 in Washington.

FIVE YEARS *without* A SERVICE FAILURE

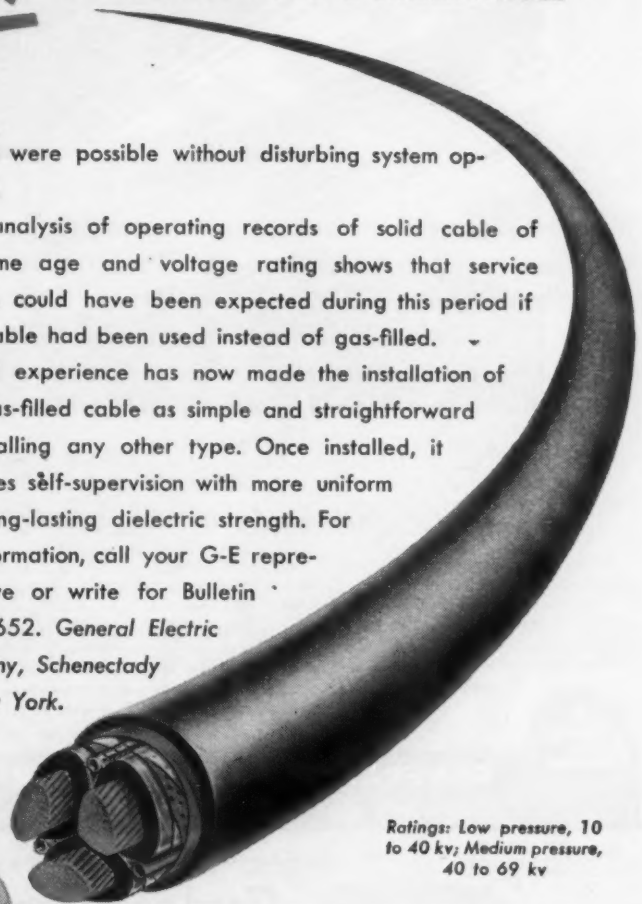
FIVE years ago, G-E gas-filled cable was selected for two important 27-kv feeders under New York's East River. These feeders are among some 20 installations of this self-supervising cable put in by the Consolidated Edison Company of New York, Inc., including several vital ties between generating stations.

"No service failures have occurred in any of the 138,000 feet of gas-filled cable installed on the system," states an A.I.E.E. article.* Wherever sheath damage or leaks in cable joints or terminals have developed, it has been possible to maintain gas pressure and continue operation of the feeder. The location of leaks has been quickly determined by pressure-drop measurements and gas-flow direction indicators. Repairs were possible without disturbing system operation.

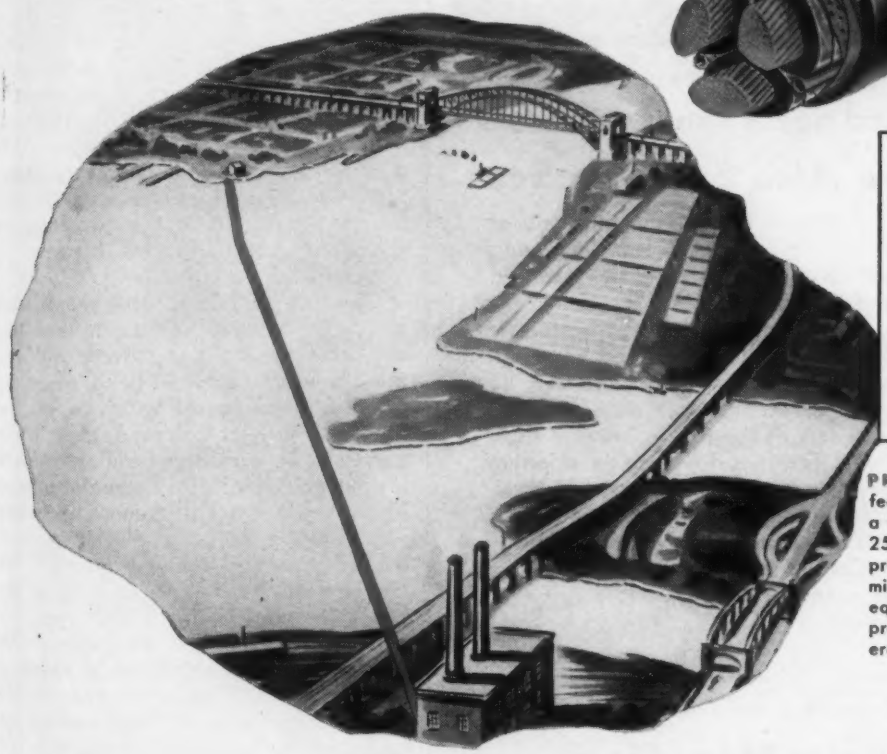
An analysis of operating records of solid cable of the same age and voltage rating shows that service failures could have been expected during this period if solid cable had been used instead of gas-filled.

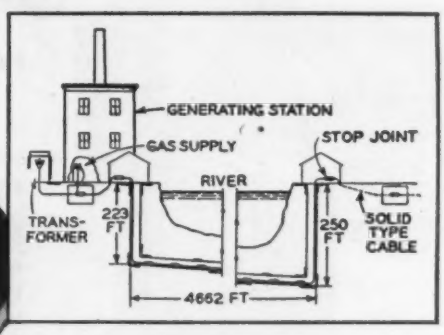
Field experience has now made the installation of G-E gas-filled cable as simple and straightforward as installing any other type. Once installed, it combines self-supervision with more uniform and long-lasting dielectric strength. For full information, call your G-E representative or write for Bulletin GEA-3652. *General Electric Company, Schenectady 5, New York.*

*—*Operation of Low-pressure Gas-filled Cable, C. T. Hatcher, ELECTRICAL ENGINEERING, Nov., 1944*



Ratings: Low pressure, 10 to 40 kv; Medium pressure, 40 to 69 kv





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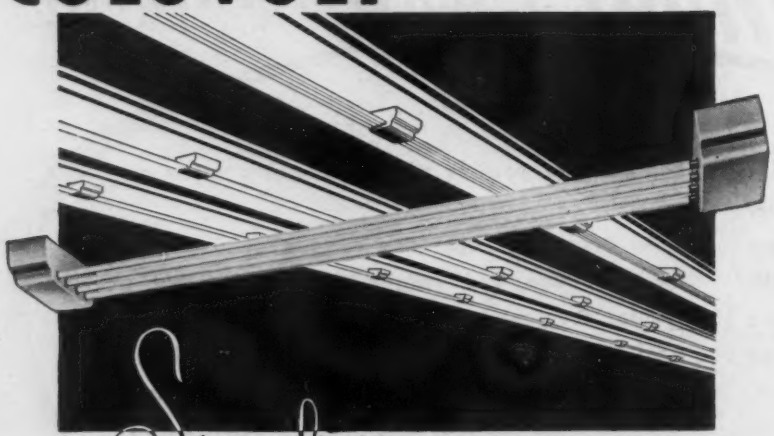

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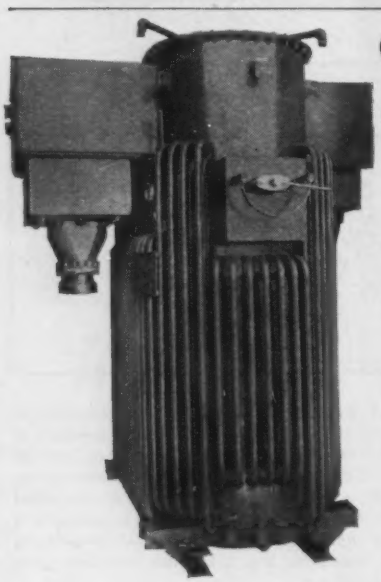

Gardner Transformers Are Also Easier to Set

Attention to even minor details of design is another factor increasing the demand for Gardner standard and special transformers.

For example, on the transformer illustrated, note the rugged base with channels so that pole jacks can be used for lifting. Note also the extra side ears at the top to provide additional facilities for ease in shipping and handling. Small details like these make Gardner transformers easier and safer to handle.

Consult this Pacific Coast specialist in connection with your transformer needs.

Gardner 750-kva, 3-phase 2400/240-volt transformer with tap changer, and pot-heads on primary and secondary installed in terminal boxes welded to the case.

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LABOR BOARD HOLDS SECOND HEARING ON DENVER CASE

The Ninth Regional Labor Board panel conducted a second hearing in Denver, July 13, to consider proper labor market areas and wage bracket rates applying to electric utilities employees. Recommendations based on facts developed at the two hearings (the first occurred May 17) would preserve the status quo on the present area—Colorado, Wyoming, Montana, Utah, Idaho and New Mexico, where wage rates are bracketed by states, and adjust future wage disputes according to a formula.

Hearings were called in an effort to discover facts on which to settle disputes arising between Montana Power Co. and the C.I.O. over wages at the concern's Kalispell plant. Diversity of viewpoints on the part of labor and management rendered useless any attempt to overhaul the prevailing conditions. The panel's compromise idea, which has yet to be approved by the entire Regional Board, follows:

"Consideration of the labor market and wage facts . . . indicate considerable differences in the labor market areas and wage rates throughout the Intermountain region and within the several states, particularly as between the larger urban areas and the smaller communities. At best it is a difficult task to set bracket rates in the electric utilities field. It is somewhat arbitrary to take state-wide market areas. Also it is unrealistic to take operating areas for wage bracket purposes. It seems impractical to attempt a two-fold or three-fold group of areas by size of communities.

"Because Montana presents an outstanding example of the difficulties presented above, it is moved that the present wage brackets be allowed to stand for the operating areas of the Montana Power Co., and that wage questions be considered under the following principle: . . . by maintenance of historical rate differences in cents per hour as between the two companies' rates and *existing* rates of the Montana Power Co. In administering this principle, the historical wage relationship should be determined by taking either the relationship existing in April 1943, or a representative period of prior years, and should be made on a basis of comparison of rates for the following classifications: Linemen, groundmen, servicemen, plant shift operators, firemen, metermen.

". . . it is recommended that, until some compelling reason requires consideration, wage brackets in other states be allowed to stand as presently established."

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U BOLT *construction*

won't crush even *extra flexible* wire strands!

BURNDY VARILINE ELECTRICAL CONNECTORS

Flattened U Bolts on the Variline electrical connectors provide a smooth, *extra wide* gripping surface . . . rather than a narrow grip which might damage cable strands.

This explains the wide popularity of the Variline . . . especially for connections on flexible or extra flexible cables. The flattened U Bolt, which is forged for toughness and high-strength, grips over a *long* cable area . . . grips it with high holding power without crushing even the smallest strands. The cast parts of these connectors are made of high-strength lithium-copper alloy. Variline connectors are available as terminals, tees, links, reducers, studs and many other combinations; for cables from #8 up to 2000 Mcm. Each individual connector accommodates a wide range of cable sizes. Thus, a small stock takes care of many requirements. Send for all the facts. Write to . . . Burndy Engineering Company, Inc., 107-V Bruckner Boulevard, New York 54, N. Y.

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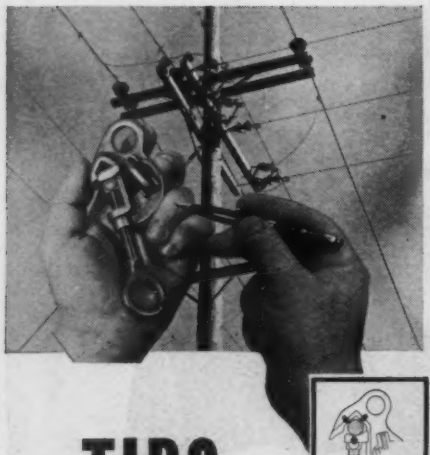

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Perma-Grip
TAP CLAMPS
for permanent or temporary taps

Tips Perma-Grip Tap Clamps make economical, dependable hot tap connections that may be either permanent or temporary. Permanent because they stay put without vibrating loose—temporary because the eye screw is made to resist corrosion and may be readily unscrewed with a Clamp Stick when line changes are made. Perma-Grip Clamps are made for tapping to aluminum, copper or steel conductors. The range of sizes is complete to meet all requirements and every clamp has these distinctive features which years of development have proven most desirable and necessary.

THREE POINT CONTACT with conductor enables Tips Tap Clamps to handle the load without heating or burning and provides a tighter grip.

POSITIVE PRESSURE JUMPER CONNECTION makes a tight vibrationless contact that doesn't heat or burn.

CONTROLLED ELECTRICAL CONDUCTIVITY equals that of the maximum size jumper wire for each clamp—No excess weight—Sufficient conductivity in every size.

HIGH CORONA VALUE—minimum power loss—minimum corrosion.

FULL MACHINE CUT NC THREADS for quick, easy application, vibrationless grip and minimum danger of sticking. NF threads OPTIONAL.

HIGH MECHANICAL STRENGTH with average yield point of 165 in lbs. torque on eye screw and ultimate strength of 150 to 500 in. lbs. depending on size.

Deliveries are slow, therefore it is wise to order well in advance of the date clamps are needed. Consult your Tips Tool Catalog and order from your regular source of supply, specifying Tips Perma-Grip Clamps.

A·B·CHANCE CO. CENTRALIA MISSOURI

WEST COAST POWER CO. COMPLETES DISSOLUTION

West Coast Power Co. ended more than 20 years of business in Oregon and Idaho early in July, when it withdrew articles of incorporation from the Oregon corporation commissioner.

Dissolution of the company followed acquisition by the California Pacific Utilities Co. of San Francisco, of remaining West Coast properties in the John Day—Canyon City area of eastern Oregon. Pioneer lines that West Coast acquired along the Oregon coast in 1924 have been sold to PUDs, and its properties serving the Sun Valley and Haley districts of Idaho were sold last year to the Idaho Power Co.

Legislation Would Cut Red Tape for Bonneville

The House passed and sent to the Senate in July a bill allowing the Bonneville Power Administration to compromise certain claims against the government resulting from its operations, bargain collectively with the employees, and otherwise administer its operations with a minimum of the governmental red tape which must be followed by other agencies.

The legislation, which was agreed to by private companies competing with BPA, includes numerous administrative privileges which have long been enjoyed by the Tennessee Valley Authority and which are held necessary to the most efficient operation of a government business.

PG and E Strike Threats Ended by Compromise

Strike threats among 4,000 employees of Pacific Gas and Electric Co. were ended early in July, when a compromise wage settlement was reached by company officials and the International Brotherhood of Electrical Workers. Under the settlement, wages will be increased 10% for physical workers and 9% for clerical workers, with WLB approval, when a 40-hour week is resumed.

A strike was voted in April but was delayed pending further WLB hearings. WLB late in June refused to reconsider an order denying an 18½% raise, and the union resumed its plans for a strike, which was averted by the settlement.

● USBR is discussing construction postwar of a modern town at Grand Coulee Dam. Approximately 500 houses would replace temporary structures built to house workers during dam construction, and plans include churches, schools, a public library and shopping district. Stores and other service establishments would be built by private interests, operating under lease, to conform with building codes and the general architectural theme of the community, according to Frank A. Banks, USBR regional director.

San Diego Line Gets Okay from Federal Body

Construction by San Diego Gas & Electric Co. of ten miles of 12,000-volt line with transformers and substations to serve 9,000 acres of nearly virgin agricultural land in Borego Valley, southern California, has been approved by the Federal area production urgency committee.

The extension will provide electric service for pumping water to irrigate and transform into a producing area the hitherto desert land on the east side of the Sierra Nevada Mountain coast range. Application has been made to the War Production Board in Washington for permission to build.

● ENDING a two-year political battle, citizens of Safford, Ariz. recently voted 159 to 28 to purchase properties of Arizona General Utilities. Two years ago, Safford voted down the Utility purchase, and subsequently residents of nearby Thatcher approved a $400,000 bond issue to take over the properties. In an appeal, the state supreme court ruled the sale illegal on grounds that one small community could not purchase utility property located in another community.

● TUCSON City Council has voted to institute condemnation proceedings against property of Tucson Gas, Electric Light & Power Co., following breakdown of negotiations between the city and Federal Light & Traction Co., which controls the properties. Voters of Tucson have authorized purchase of the utility properties but no bond issue has been voted, pending completion of price negotiations.

● WEST CANADIAN HYDRO ELECTRIC CORP. has completed erection of a new substation at Vernon, B. C. T. M. Gibson, company superintendent, states the new station will more than double electric power services for Vernon and will provide adequate energy for possible developments of postwar industry.

● HIGHLINE Electric Assn., Holyoke, Colo. has awarded a contract amounting to $407,870 to A. B. Reither, Englewood, Colo., for construction of 464 miles of line to serve the co-op's 583 members.

AN AUTOMATIC OF DISTINCTION

This time-tested Samson Duo-Dial-A-Heat Flatiron offers high quality and latest features at a popular price. Duo-Dial measures heat to suit the fabric and adapts it to the ironer's skill and speed. Plastic air-cooled handle, tapered point, bevel edge, built-in cord, rock-to-rest stand. 1000-watt steel-rock unit.

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FACTS ABOUT SAMSON UNITED TODAY AND FOR THE FUTURE

Right now limited numbers of Samson Automatic Flatirons are on their way to Samson dealers. In the near future more of our war-expanded facilities will be used to provide larger and larger quantities of these Samson Automatic Irons.

Other quality-built Samson appliances, including the Samson Heating Pad with 3 Fixed Heats and Safe-T Selective Heat Circuit, the Samson Variable Control Table Range and the Samson Safe-flex Rubber Bladed Fan will follow as soon as conditions permit. Watch for further announcements concerning these and other Samson United items.

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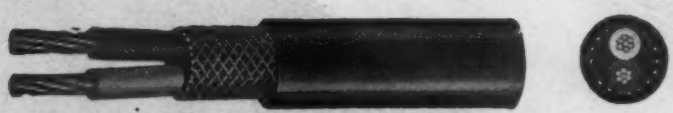

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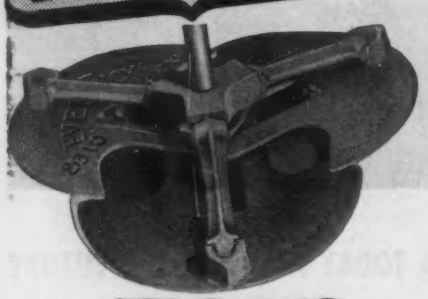

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B. C. HOLDING COMPANY BOND ISSUE APPROVED

Approval has been granted by the lieutenant-governor in council for a new $10,000,000 bond issue by the B. C. Power Corp., President W. G. Murrin announced at Vancouver, recently. The money is being raised to finance preliminary development of power projects designed to meet expanding demands for service, he said.

The bonds, paying 4% and maturing in 1965, will go on sale immediately, and B. C. brokerage houses already have put in requests for $4,000,000 worth.

Among the projects to be financed are the Bridge River power development, the new Main Street substation, gas plant extensions both in Vancouver and in Victoria and the purchase of rolling stock, as it becomes available for Vancouver and on the Island.

Funds derived from the sale of the bonds will be in addition to regular working capital, Murrin said, adding that it was not expected to cover any more than the preliminary development of the projects. "As time goes on and more money is required to complete work, other bond issues will be made," he stated.

Smallest denomination offered in the new issue is $500. The bonds are being issued to the public at par.

Competitive Bidding on Security Sales Opposed

At recent hearings California utilities expressed opposition to adoption by the State Railroad Commission of a rule requiring competitive bidding on sale of securities.

A policy of negotiated utility financing rather than competitive bidding was favored by spokesmen for Pacific Gas and Electric Co., Southern California Edison Co., San Diego Gas & Electric Co. and others of the 59 companies that had been invited by the commission to show cause why a competitive bidding rule should not be adopted.

Hearings have been adjourned until August. The California banking department and commissioner of corporations have intervened against a competitive bidding rule.

● VALUATION of electric light and power companies in the state of Washington increased about $3,000,000 in the last year, a gain in public utility tax valuations second only to the telephone companies, it was announced in July. Assessments for all public utilities increased $7,500,000 to $400,000,000 for 1945.

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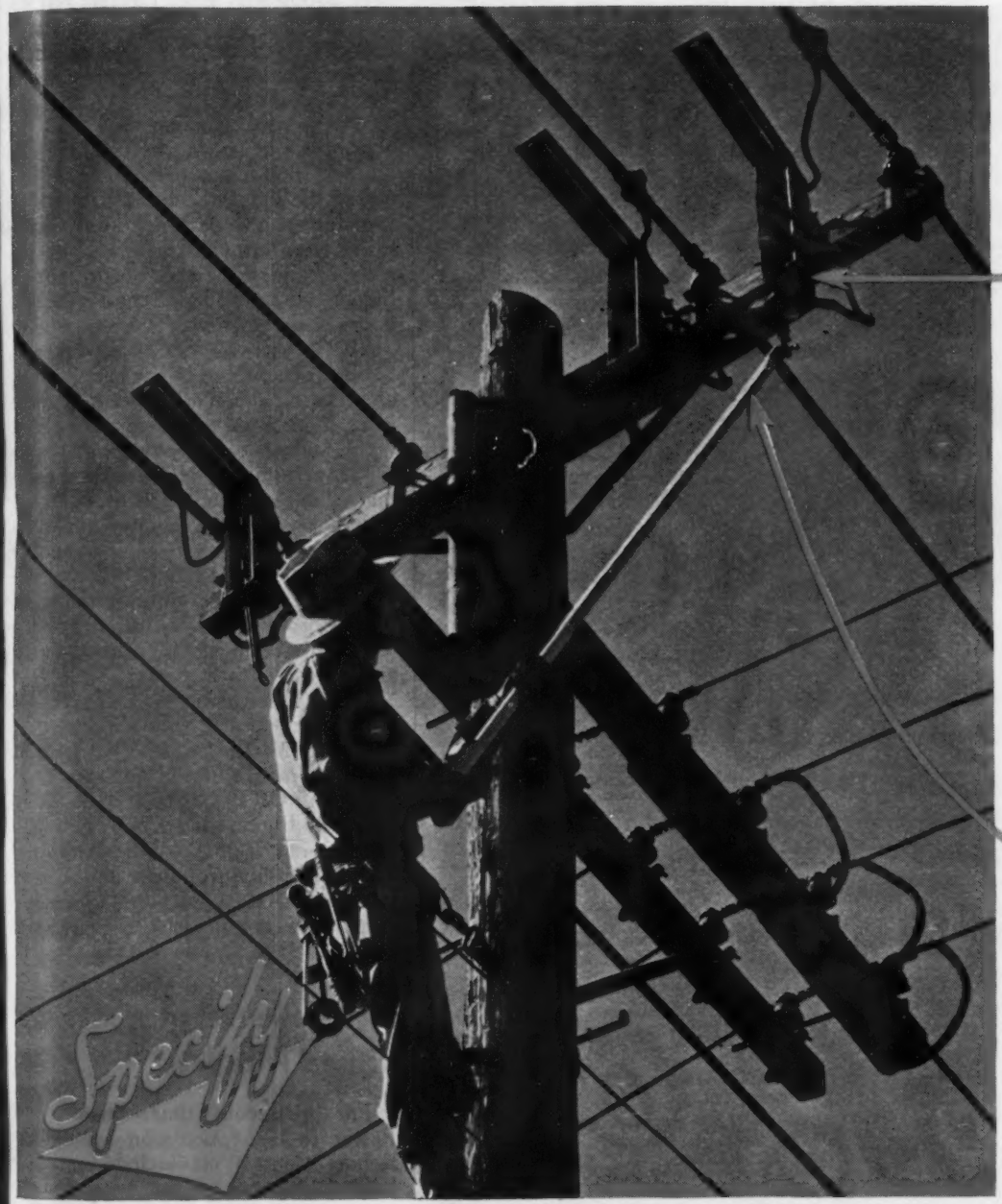
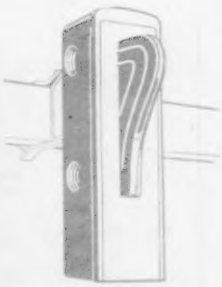
Less Maintenance Tomorrow





KEARNEY DEAD BLADE DISCONNECT SWITCH

Parallel bus bar copper blades with line pressure contacts and positive latching device are housed in a high quality wet process porcelain box, with Bakelite door. Special latch permits door to stay open during operation. Large pull ring is easily reached with hook stick.

KEARNEY HI-LINE DISCONNECT STICK

Laminated wood poles with ferrule type metal head, securely pressed and riveted on one end. Light in weight, yet will stand much abuse. Available in 1¼" diameter from 4' to 12' long, and 1½" diameter from 10' to 18' long.

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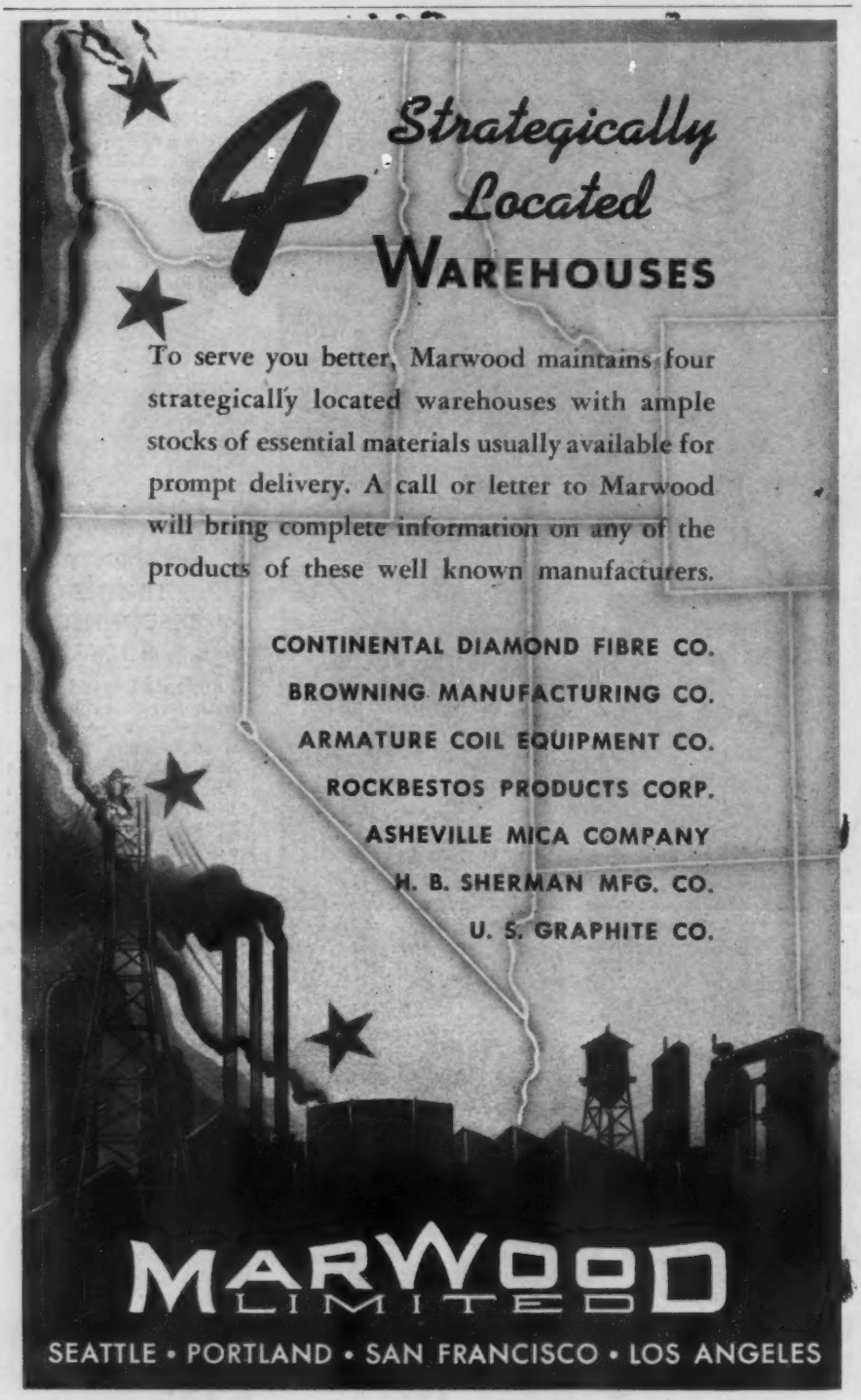
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B. C. ELECTRIC ADOPTS EMPLOYEE SELECTION PLAN

An employee selection program has been adopted by B. C. Electric Railway Co., which recently announced that it had employed Dr. R. E. Moore, industrial psychologist, to aid in the work. The program is headed by O. A. Peterson, personnel manager.

Findings of Dr. Moore and his assistant will not affect present employees, unless the employee himself wishes to transfer to a department more suited to his peculiar ability. The chief purpose of the project is to prevent the hiring of any new employee who doesn't "measure up," it was stated.

"It works two ways," said Peterson, "to our benefit and to the benefit of the employee. A man who is happy at his work is an asset to the company."

"A man who is away above his job is just as unhappy and unsuited as the man who is struggling with something over his head," Dr. Moore stated. His tests are calculated to determine whether the applicant is "bull-headed, unreliable, erratic, unreasonable, immature, soured or disillusioned." The tests also reveal more promising characteristics.

B. C. Electric employees returning from war service will be placed by Robert B. Middleton, who has been appointed rehabilitation officer under Peterson. Of the 876 employees enlisted and guaranteed re-employment and seniority rights, 150 have returned. The 121 ex-airforce men and 150 ex-servicemen taken on the staff recently will be given number two priority on company jobs, it was stated.

Puget Power Report Wins National Prize Again

For the second time, Puget Sound Power & Light Co. won the Annual Report Contest conducted by Reddy Kilowatt Service of New York. It is the only company to have won the contest twice and in two succeeding years. Object of the competition is to encourage the clarification of annual reports and make them understandable to the average stockholders and customer. To qualify reports must be in simple language, must dramatize accomplishments and build goodwill. The judges, M. S. Rukeyser, economic analyst; S. B. Williams, editor, *Electrical World* and Col H. S. Bennion, vice-president and managing director, Edison Electric Institute, commended the report for streamlining its statistics and illustrating graphically with charts much of the data. Inclusion of representative institutional advertising was also commended.

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FREIGHT RATES *and* INDUSTRY LOCATION

A SIGNIFICANT decision, announced by the Interstate Commerce Commission last May, will take preliminary effect on the 30th of August. It will eliminate some of the advantage in freight rates which Eastern shippers have enjoyed over shippers of the South and West.

The decision has been enthusiastically hailed as an Emancipation Proclamation for industrial development in the South and West. It has also been roundly condemned as a meddlesome control measure that ignores valid differences in haulage costs, and recklessly blots out one of the important factors in determining the location of American industry.

Cooler appraisals indicate that the net effect of the rate changes will be far less drastic than predicted by the more passionate advocates or adversaries. Nonetheless, it is important for the business world to be informed both upon the principle at issue, and upon the forseeable consequences of the ICC ruling.

What The Decision Calls For

The Commission's order, unless modified, or successfully contested in the courts, will require: (1) the eventual establishment of a single freight classification, or grouping of commodities for rate-making purposes, for application throughout the United States; (2) a single level of *"class rates"*—or rates established for groups of commodities and primarily applying to manufactured and semi-manufactured articles of high value—in the area east of the Rocky Mountains. This level is to be about 15 per cent higher than the present Eastern scale.

Because it will take some time, probably several years, to work out a uniform classification in place of the three major classifications now existing, a preliminary adjustment is provided.

Under this adjustment the existing classifications will remain in effect, but the rates on articles moving on *class rates* will be increased 10 per cent in Eastern or Official Territory—the area east of Lake Michigan and the Mississippi River and north of the Ohio River. On the other hand, the rates will be reduced 10 per cent on articles moving on class rates in the South and West, and on those moving interterritorially.

What The Problem Was

At the present time there are marked differences in the levels of the basic scales of class rates in the five major rate territories—Eastern or Official, Southern, Western Trunk-Line, Southwestern, and Mountain-Pacific. It is difficult to average the levels of rates, but if the level of the class-rate scale in Official Territory is taken as 100, the levels in the other territories may be roughly considered as follows: Southern, 139; Western Trunk-Line, 128, 146, 161, 184 in Zones I, II, III, and IV, respectively; Southwestern, 161; Mountain-Pacific, 166.

These are over-all comparisons. On many individual articles the differences in levels of rates are greater or less than indicated because of offsetting differences in regional classification schemes. In many cases, the use of exceptions to the classifications and of special commodity rates has reduced the regional disparity in rates. In fact, on some articles, particularly on certain low-grade traffic such as logs, pulpwood, bricks, coal, sand and gravel, the South and the West have actually had lower rates than Official Territory. The rate disadvantage of the South and West has been principally on manufactured articles.

The territorial differences in class-rate levels have complicated the problem of constructing rates from a point in one territory to a point in another. Today, such a rate tends to represent a blend of the levels in effect at the place of shipment and at the destination. Thus manufacturers and dealers in a higher-rated territory are likely to see themselves at a disadvantage when they attempt to sell goods in a lower-rated territory against competition located there.

Now, if differences between territorial rate levels are removed, the *inter*territorial freight-rate problem largely disappears. So it is an important question whether such differences are justified. The Commission has found that they are *not* justified either by differences in transportation costs or by

other valid considerations. From that finding came the order to establish a uniform level of class rates and a single freight classification.

The Decision And The Map Of Industry

What effect will this decision have on the location of industry in the United States; and what effect will it have on the economic development of the East, the South, and the West?

Today, many in the West and South believe that their higher class rates have seriously retarded the industrial development of these areas, and promoted the concentration of manufacturing in Official Territory. They point out that Official Territory has over 50 per cent of the population of the country, had nearly 70 per cent of the persons employed in manufacturing in 1940, and accounted for nearly 73 per cent of the "value added by manufacture" in 1939. Boasts of industrial development in the South, and to some extent in the West, in recent years are accompanied by claims that this would have been greater but for the freight rate structure.

Another point gets into the argument. Official Territory is not only the country's most highly industrialized section, but also its greatest consuming territory. It is the market which nearly all manufacturers desire to reach, particularly when they have a surplus to sell. Here again is occasion for an outcry by producers outside of Official Territory against the consequences of their high rate levels and the levels of interterritorial rates. Under the circumstances it is not strange that the South and West have argued long and volubly for mile-for-mile equality in rates.

Those in Official Territory deny that the South and West have been handicapped by the rate adjustment, but at the same time look with apprehension at the loss of their rate advantage.

What's The Effect?

However, now that the ICC's ruling is about to be put in operation, it is time for the colorful statements of the debating period to give way to a sober appraisal of what the consequences are likely to be.

In the first place, it should be noted that the preliminary adjustment will affect only a small fraction of the traffic. Estimates indicate that only about 4 per cent of the full-carload traffic moves on regular class rates. About 11 per cent moves on exception ratings which are not affected by the preliminary order; and about 85 per cent moves on commodity rates, which were not within the scope of the Commission's decision. The proportion of less-than-carload lot traffic affected is much greater, since a large part of it moves on class rates; however, less-than-carload traffic constitutes less than 1½ per cent of the total tons carried.

The permanent rate structure will probably affect more traffic than the preliminary order since, in the establishment of a uniform classification containing more classes than at present provided, many articles now moving on exception ratings are likely to be brought within the scope of the classification, and the same may be true of some articles moving on commodity rates.

But, even if a large proportion of the traffic were affected by the Commission's order, or if the principle of equality in rate levels is eventually extended to much of the traffic moving on commodity rates, these freight-rate adjustments cannot be expected to revolutionize the pattern of industrial location in the United States.

It seems evident that most industries now found in Official Territory are located there for other advantages than that of a lower level of freight rates, undeniable as such an advantage is. Insofar as that is the case, they have little to fear from equalization of the rate levels. For those which have, indeed, been dependent upon preferential rates and otherwise badly located, the removal of the preference and their consequent shift to some area possessing a real locational advantage would be desirable from the point of view of the national economy.

While the high degree of industrial concentration in Official Territory does not rest on such a flimsy basis as a lower level of class rates, the Commission's decision does remove one existing handicap to the growth and development of the South and West. The new adjustment should permit all sections of the country to develop the industries for which they have natural advantages. It should contribute to a sounder regional specialization than we have heretofore had.

This decision will neither destroy the economy of the industrial East, nor will it, overnight, assure the industrial flowering of the South and West. It constitutes one sound step toward establishing that equality of opportunity for all sections of the country which is essential to a nation that bears the proud title of The *United* States.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Co., Inc.

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CABLE LIFE "PRE-VIEWED" BY YEARS OF EXPOSURE

Okonite's Proving Ground Duplicates Actual Operating Conditions

All kinds of weather and four kinds of soil provide thoroughgoing performance "pre-views" at the cable proving ground at The Okonite Company's Passaic, New Jersey plant.

About to start its ninth year of carefully-recorded cable service studies, this unique *outdoor laboratory* is dedicated to evaluating the useful life of all types of insulation both above and below ground under all severe operating conditions. Believing that time and time alone is the only true means of determining what a cable will do, Okonite engineers put principle into practice with the realistic creation of actual service conditions rather than artificial "accelerated aging".

Buried directly in various types of earth, pulled into conduit or installed overhead — network, control, primary distribution and portable power cables are constantly operating under controlled conditions of temperature, voltage and loading.

At specified intervals they are taken up, sections cut from the cable and detailed tests conducted under the independent supervision of The Electrical Testing Laboratories.

Test Conditions

Cables under test are installed in four concrete troughs, each 50 ft. long by 4 ft. wide and 4 ft. deep. These troughs, open at the bottom, are each filled with a different type of soil:

1. Top soil saturated with corrosive water from a manhole.
2. Soil with a layer of manure over the cables to simulate conditions of decaying organic matter.
3. A mixture of 99 lb. of sand and 1 lb. of lime which is subjected to a periodic pH test and maintained highly alkaline.
4. Soft-coal cinders regularly wet with a sulphuric acid solution to render them positively acid. Given a regular pH test and acidity maintained.

Cables in each trough are in two layers, Spacing of cables was selected to allow control and signal cables to be slightly warmed by network cables which are subjected to current loading. The majority of cables are buried between 30 in. and 36 in. deep.

Buried Since 1937

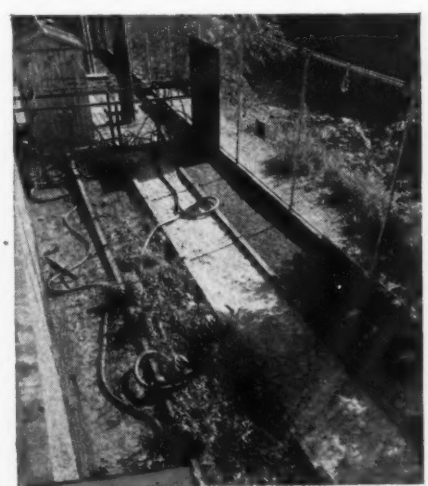
Four main types of cables are installed in the troughs in the proving ground.

1. Network cables. Nine cables representing all constructions, including fibrous and rubber covered; 250,000 circ. mil. single-conductor, insulated for 600 volts, operating at 120 volts and loaded in cycles nine hours a day, five days a week, to give a copper temperature of approximately 60 deg. C. Network cables in all troughs are in series across 120 volts.
2. Control cables. Eleven seven-conductor, rubber insulated cables with various types of metallic and non-metallic sheaths in each trough energized at 120 volts but not loaded.
3. Underground primary distribution cable. Four different commonly-used types of 5-kv. non-metallic sheath cable in each trough energized at 7.6-kv. but not loaded. Each trough contains 50-ft. lengths of each type of cable.
4. Portable high-voltage cable. Two types, shielded and non-shielded, 12.5-kv. three-conductor, dredge or shovel cables run at random in the yard on the top of the ground and moved each week. Two types are connected in series and ends connected to 12.5-kv. busbars.

In addition to the underground cables, two 30-ft. poles have been erected carrying more than a dozen types of insulated aerial cable and line and tree wire energized at 7.6-kv. from the busbar structure. Interconnecting these overhead "circuits" are three conduit risers on each pole containing four test cables each.

As tests are tabulated, valuable trends have already been disclosed. While eight years are too short for final conclusions, proving-ground results have indicated significant tendencies. For example, in the case of exposed cables, Okolite-Okoprene (Patent 2,312,058) is showing to advantage over the fibrous type of rubber insulated cable which has suffered braid deterioration, tape erosion and corona cutting.

This is but one instance — one forerunner of benefits to come. As time goes on and more and more facts accumulate, Okonite engineers will be guided to a greater degree by this recorded test data, and will pass along greater service-life knowledge in the form of improved electrical wires and cables. The Okonite Company, Passaic, New Jersey.



Underground portion of proving ground at end of first full year of operation.

Cables are periodically exhumed, sections removed, ends sealed for reburial.

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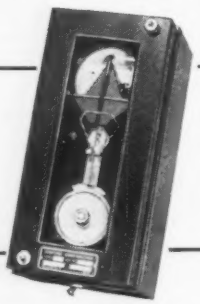
TYPE VB BATTERY CHARGING VOLTAGE REGULATOR



Designed for application with rectifier charging equipment and motor generator sets large enough to replace average drain on a storage battery! This recently improved regulator serves to adjust the position of a rheostat in series between the battery and the charger or in the shunt field of the charging generator to correct for any deviation from 2.15 volts per cell. It maintains 25.8 volts for a 12-cell battery, 51.5 volts for one of 24 cells, and 129 volts for 60 cells. Recent improvement centers in addition of a transfer switch which serves to raise the voltage to 2.24 or 2.33 volts per cell for application at intervals of a freshening overcharge as recommended by the battery manufacturer. The mechanism is assembled in a housing that measures 4½ in. in width by 9½ in. in height.

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CONFERENCE DISCUSSES LIGHT METALS INDUSTRY

Possibility for continuing and broadening the manufacture of aluminum and magnesium, as well as the fabrication of consumer products from these metals, in the Pacific Northwest was explored in the so-called Light Metals Conference at Seattle late in June. The conference was sponsored by the Western States Council, composed of the managing executives of Chambers of Commerce in the eleven Western states.

Speakers from government and industry pointed out that the light metals industry, established in the Northwest originally to meet wartime demands, was overbalanced in that it consisted chiefly of the manufacture of aluminum from alumina shipped in from the Middle West. The industry in that area now lacks fabrication of shapes and products, and the market analysis presented at the conference indicated an opportunity for the establishment of this branch of the industry, as brought out by Nathanael Engle, director of the bureau of business research, University of Washington. C. T. Bakeman, Puget Sound Power & Light Co., told of the post victory products survey on light metals conducted by the Seattle Chamber of Commerce. In this he emphasized that the fabrication part of the aluminum industry was the part which adds wealth, creates jobs, pay rolls, and community income in greater degree than does the manufacture of the raw metal.

An analysis of the aluminum industry was presented by John Sullivan, Battelle Memorial Institute, Columbus, Ohio, in which the prospect of using Northwest clays as the basic ore was prospected. Irving Lipkowitz, economic advisor to the U. S. Department of Justice, Washington, D. C., put in a plea for greater competition in the aluminum industry. Costs of aluminum manufacture in the Northwest were analyzed by Ivan Bloch, chief of the market development division, BPA.

C. E. Magnusson, U. S. Senator from Washington, speaking at a luncheon during the conference, said that the disposal of Defense Plant Corp. owned aluminum plants in the Northwest presented a difficult problem, because the value of the plants was uncertain and their cost figures vague. DPC can lease its properties to private operators for five years after the war, and it might be well, Senator Magnusson suggested, to do this, in order that costs and values could be more adequately determined. He echoed a previous speaker in expressing the desire to get more competition into the aluminum industry after the war.

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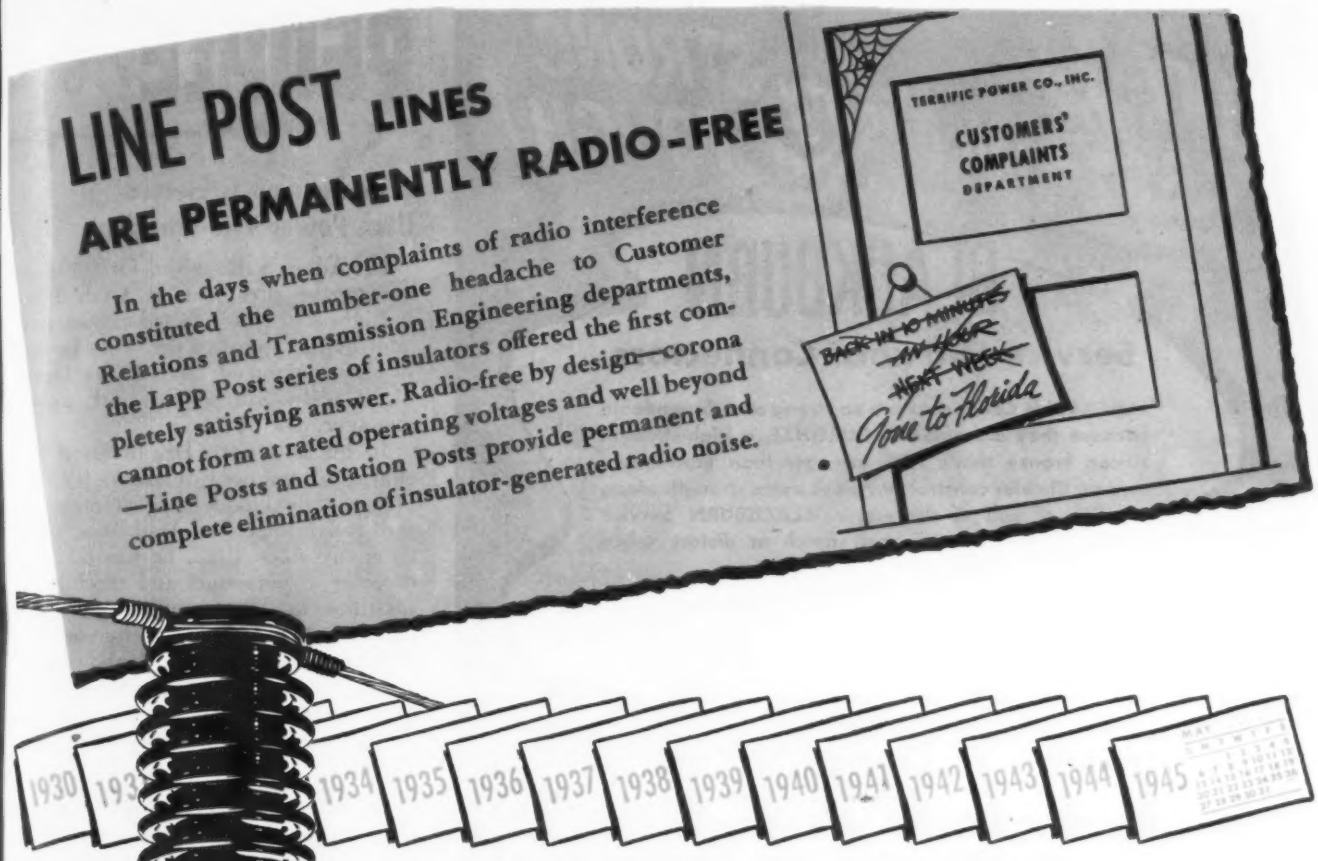
ALL the strength and durability inherent in steel are combined—with definite economies—in *Crapo* Galvanized Steel Strand. Heavy, ductile, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide lasting protection against corrosion.

Ask the distributor of *Crapo* Galvanized Products near you or write direct for further information!

INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA

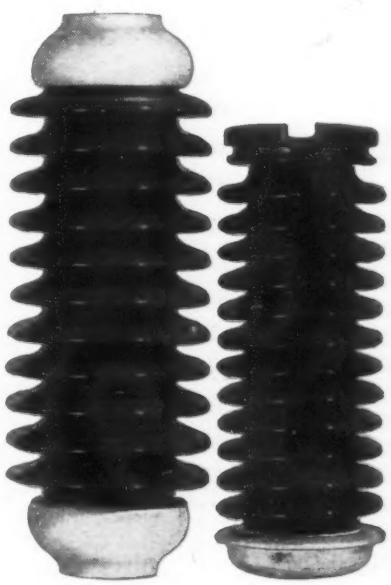
LINE POST LINES ARE PERMANENTLY RADIO-FREE

In the days when complaints of radio interference constituted the number-one headache to Customer Relations and Transmission Engineering departments, the Lapp Post series of insulators offered the first completely satisfying answer. Radio-free by design—corona cannot form at rated operating voltages and well beyond —Line Posts and Station Posts provide permanent and complete elimination of insulator-generated radio noise.



LAPP LINE POSTS HAVE A 15-YEAR SERVICE RECORD

The first shipment of Lapp Line Posts went into service 15 years ago. The installation was the one which had inspired The Line Post design—a particularly bad, and previously unsolved, dirt condition. Since then, hundreds of thousands of Lapp Posts have gone up, in many cases a desperation answer to a difficult service problem—dirt condition, mechanical attack, radio noise, arcover failure. And the 15-year service record of these insulators shows them to stand up better, with fewer line outages, and lower replacement ratio, than any other insulator now in use.



Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, N. Y.

TINY— but Mighty STRONG and TOUGH!

BLACKBURN

Service Entrance Connectors

BLACKBURN Connectors are so strong and dependable because they are made of DURONZE, a high-strength silicon bronze that's 75% stronger than hard-drawn copper. Circular construction gives extra strength along the line of pull of the screw. BLACKBURN Service Entrace Connectors will not stretch or distort when tightened — will not come loose.
And they're exceptionally economical.

Over 100 conveniently-located Jobbers' Stocks

JASPER BLACKBURN PRODUCTS CORP.
Main and Clinton Sts., St. Louis (6), Mo.
Builders of Quality Connectors for Over 10 Years

GEO. E. HONN CO.
420 Market St. San Francisco, Calif.
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Manufacturers' Representative for:

American Cross-Arm, Inc.
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Pin-type and Suspension Insulators
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Wire Rope Fittings

EASTMAN Tags

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HOUSE of SERVICE

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FULL AUTOMATIC EQUIPMENT

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743 EAST 60th STREET, LOS ANGELES, 1
SERVICE REPRESENTATIVES IN ALL WESTERN STATES

PEOPLE
made this news

A. S. Bennion Is Elected Utah Power Vice-President

Dr. Adam S. Bennion, former assistant to the president of Utah Power & Light Co., was elected a vice-president by the board of directors in June, it was announced recently by George M. Gadsby, president and general manager.

In his new post, Dr. Bennion is in charge of company relations with employees, stockholders, customers and the general public. With the power company since 1928, he has served as director of personnel and recently was instrumental in formulating a company employee retirement income plan.

A graduate of the University of Utah, he received a master's degree from Columbia and a doctorate from the University of California.

S. S. Bloom Joins Firm of Management Consultants

Samuel S. Bloom, for many years associated with the California Railroad Commission, has become consulting engineer in public utility matters with the San Francisco firm of Charles C. Bowen & Co., management consultants.

Graduate engineer of the University of Idaho, Bloom was an aviation officer in World War I. He did engineering work for the Union Pacific Railroad and the United Verde Copper Co. before becoming affiliated with the California Railroad Commission.

He is a member of the American Institute of Electrical Engineers and is a registered engineer.

● L. N. McCLELLAN recently was appointed assistant chief engineer, electrical and mechanical division of the Bureau of Reclamation, and will be one of three to assist Chief Engineer Walker R. Young at Denver. The others are W. H. Nalder, civil engineering division, and Ralph Lowry, construction division. McClellan was graduated from the University of Southern California, and from 1911 to 1917 was superintendent of power of the Salt River project in Arizona.

● A. X. SCHILLING has joined the staff of the advertising and publicity department of Southern California Edison Co., according to Howard Hayes, manager of the department. Schilling has been with General Electric Co. in Los Angeles handling publicity and advertising material.

—from the COMPLETE LINE OF

OLIVER

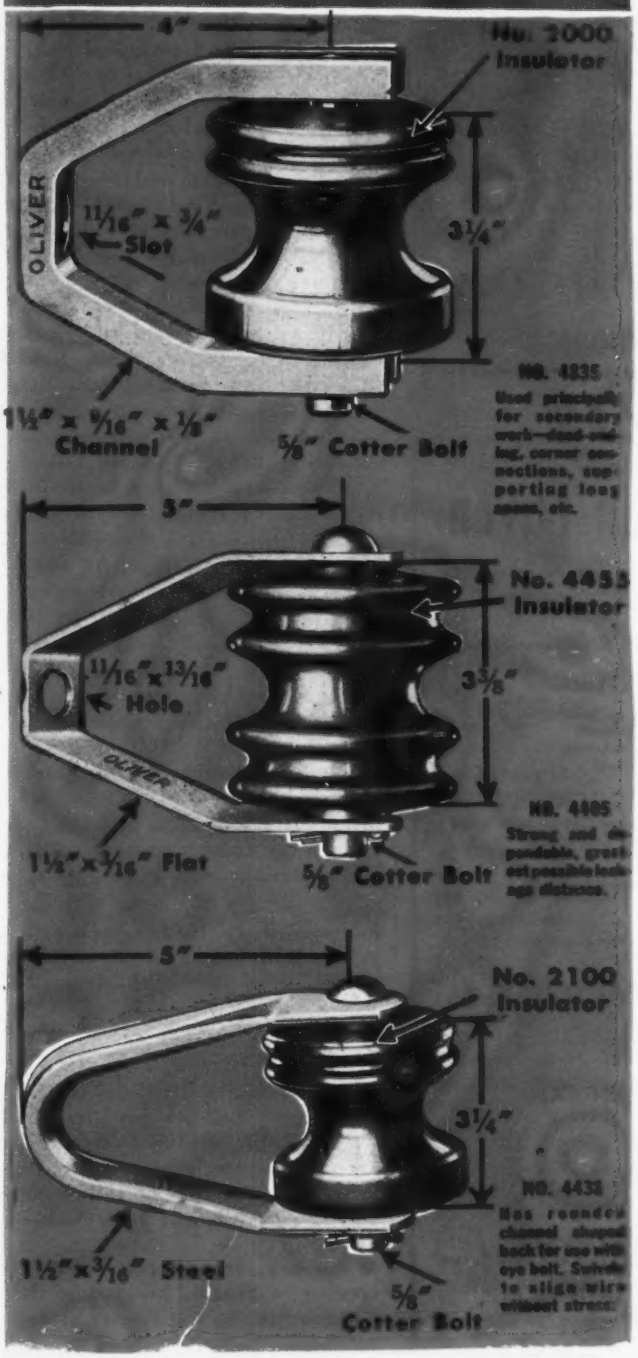
POLE LINE MATERIALS

Clevises

FOR ALL TYPES OF CONSTRUCTION

MECHANICALLY *Strong*
ELECTRICALLY *Efficient*

TYPICAL OLIVER DESIGNS



You have found that the right clevis at the right time makes a neater, better, faster job of erection. Realizing that utility men need a variety of styles of clevises, Oliver has developed a complete line. Are you familiar with them? You will find styles for every type of application—every one designed, built and *service tested* under operating conditions.

They combine great mechanical strength with high electrical efficiency to provide long life and satisfactory service. Porcelain insulators are carefully selected for the job. Metal parts are made from open hearth steel, hot-dip galvanized.

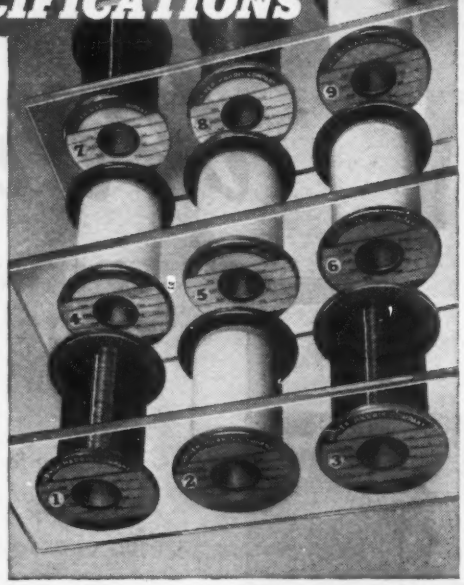
It will pay you to become familiar with these important *economy aids* now!

All Oliver Clevises are described fully in Catalog 43, which covers the complete line of Oliver Pole Line Materials.

OLIVER
IRON AND STEEL
Corporation

SOUTH TENTH AND MURIEL STREETS
PITTSBURGH 3, PA.

INSULATED
TO YOUR SPECIFICATIONS



ALL DRIVER-HARRIS
Resistance Alloy Wires

All Driver-Harris resistance alloy wires can be supplied to you with any of these individual types of insulation either in single or multiple coatings or in various combinations to meet special requirements.

The spools of D-H wire illustrated are insulated as follows:

1—Formvar Enamel Coated
2—Double Cotton Covered
3—Double Enamel Coated
4—Double Glass Coated
5—Single Silk Covered
6—Double Silk Covered
7—Enamel Coated
8—Resin Over Glass Coated
9—Single Cotton Covered

Additional technically advanced insulations now in research will be added to this list. Send us your specifications.

Famous for **NICHROME***

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Driver-Harris COMPANY

Stocked for the Coast Trade at: **ANGUS-CAMPBELL, INC.**
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ILSCO
Electrical Connectors

No, we don't ship ILSCO CONNECTORS in fancy jewel cases. Nor do we make them from castings which are heavy, costly and of poor conductivity when compared to the pure 99.99% electrolytic copper of 100% conductivity used in all ILSCO CONNECTORS.

Remember—it isn't weight that counts . . . it's conductivity!

Write for 32-page illustrated catalog.

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Remote Control Equipment—Relays—Thermostats

STERLING SIREN CO.
Electric Sirens

OPERADIO MANUFACTURING CO.
Flexifone Intercommunication Equipment

TRICO FUSE MFG. CO.
Fuses, Oilers, Clip Locks and Fuse Pullers

KNOX PORCELAIN CORP.
Electrical Porcelain.

Abe Tilles Engineer with Pacific Gas and Electric

Dr. Abe Tilles, who has been teaching in the electrical engineering division, University of California, since 1930, recently joined the engineering staff of Pacific Gas and Electric Co. At the university Dr. Tilles taught subjects related to utility operation, electric power transmission and distribution and telephone transmission.

He is widely known on the Pacific Coast, is an active member of Eta Kappa Nu, Sigma Xi, of which he is past treasurer, Society for Promotion of Engineering Education and AIEE. He has been chairman of the San Francisco Section AIEE shipyard program and is now vice-chairman of the section. He is the author of papers in professional and technical magazines and winner for 1936 of the Alfred Noble prize of the four founder engineering societies for a paper on *Spark Lag of the Sphere Gap.*

In the industrial and consulting field, Dr. Tilles has done electrical engineering for a University of California war research project, for the Kaiser Co. Richmond Shipyard No. 3, Southwestern Engineering Co., Mare Island Navy Yard, design section, Lester S. Ready, consulting engineer, and California State Highway Testing and Research laboratories. In the utility field, he has worked for the Los Angeles Bureau of Power & Light testing laboratories and the frequency change division. He has worked for PG and E twice before, the last time for a few months in 1938.

In his new position, he will be in the transmission and hydroelectric engineering division, headed by John A. Koontz, and will be primarily concerned with transmission, telephone and relay problems in connection with postwar line construction.

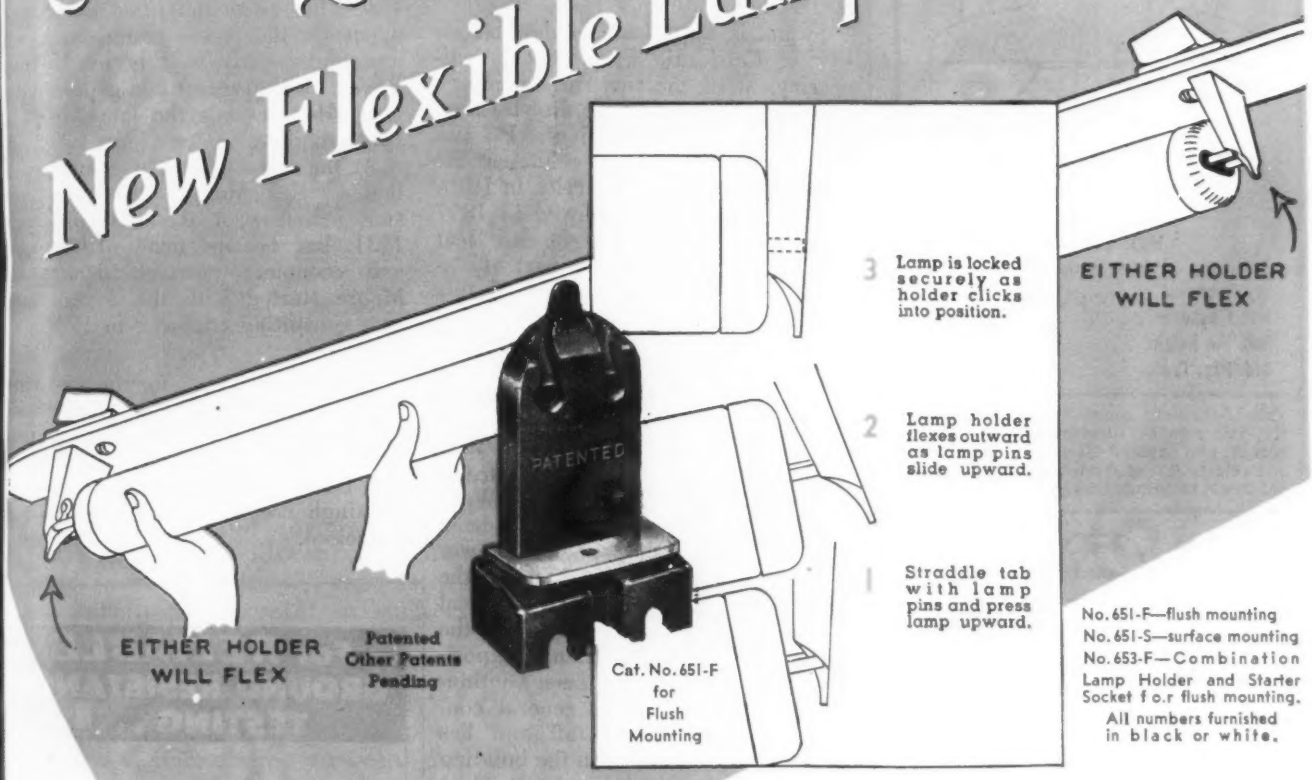
● D. J. VACHER, who has been division supervisor of commercial sales at the Ogden division of Utah Power & Light Co., recently joined the General Electric Co. in Salt Lake City to be in charge of the domestic lighting promotional work. He has been with Utah Power & Light since 1929 and first was employed in the southern division at Provo.

● GEORGE DICKIE, mechanical superintendent for the mainland system of B. C. Electric Railway Co., retired early in June. He was the oldest employee on the company's pay roll, and is also one of the pioneers of Vancouver. He will be succeeded by J. B. Nichols.

● ED LEE, former chief electrical inspector of Seattle, has joined the Win Electric Co. in the electrical contracting business in West Seattle.

Perfection — *Plus*

Lloyd's New Flexible Lamp Holder


3 Lamp is locked securely as holder clicks into position.
2 Lamp holder flexes outward as lamp pins slide upward.
1 Straddle tab with lamp pins and press lamp upward.
EITHER HOLDER WILL FLEX
EITHER HOLDER WILL FLEX
Patented
Other Patents Pending
PATENTED
Cat. No. 651-F for Flush Mounting

No. 651-F—flush mounting
No. 651-S—surface mounting
No. 653-F—Combination Lamp Holder and Starter Socket for flush mounting.
All numbers furnished in black or white.

Check These 10 Points of FLEX-LOC SUPERIORITY

1. FLEXIBLE—automatic—self-adjusting to variations in length of lamps or of the spacing of mounting holes in reflector units.
2. AUTOMATIC LOCK is positive. No need for extra locking devices to protect lamp. Absolutely safe. Lamp positively cannot fall out. Holder stands all kinds of shocks and vibrations without loosening contact.
3. SIMPLE yet sure insertion and removal. No twisting. No turning. No fussing to seat lamp in the holder. FLEX-LOC Lamp Holder does the work automatically.
4. PERFECT ELECTRICAL CONTACT made absolutely sure and positive by newly designed patented contacts which grip BOTH sides of lamp pins.
5. NEW STREAMLINE DESIGN — Projecting "tab" on lamp holder serves as a guide for inserting lamp and is a means for removing lamp.
6. SIMPLIFIED MOUNTING — Tapped hole in mounting bracket eliminates need for mounting nuts.
7. ADAPTED TO ALL TYPES OF FIXTURES (Counter lighting, continuous line lighting, in reflectors where limited space makes insertion and removal of lamps difficult.) With FLEX-LOC no turning or twisting of lamp is necessary.
8. TESTED AND APPROVED by testing laboratories. Withstands 2,000 foot pounds high impact shock tests.
9. MOLDED from strong-bodied plastic with high dielectric strength.
10. NO NEED TO CHANGE fixture layout. Engineered to fit all standard fixture spacings.

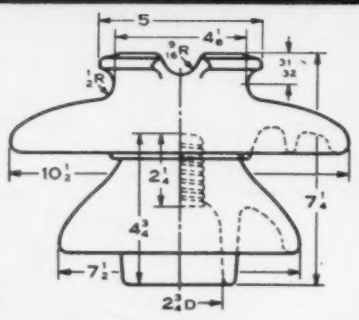
Lloyd Policy Insures Quality

LLOYD PRODUCTS COMPANY

PROVIDENCE 5, R. I.

Representatives and Warehouses in 23 Leading Cities

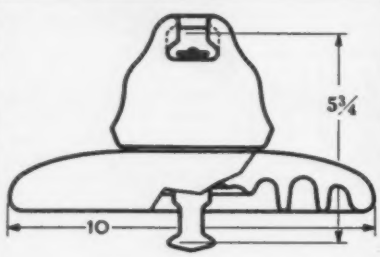
THOMAS
PORCELAIN
INSULATORS



NO. 2124-M
45 Kv. Rating

Dry Flashover	125 Kv.
Wet Flashover	85 Kv.
Rec. Pin Height	8 In.
Std. Pkg. Crate	6

This insulator generally used on 33 Kv. can also be furnished in one-piece design (No. 1924). Mechanical, thermal and electrical characteristics are well balanced insuring long life in service.



NO. 21243
15,000 Lb. Min. Combined M. & E. Rating

Dry Flashover	80 Kv.
Wet Flashover	50 Kv.
Leakage Distance	11½ In.
Std. Pkg. Crate	6

This design is offered in a wide range of spacings in both Ball-Socket and Clevis types which fulfill all strain insulator requirements.

● Service records prove these units will serve faithfully under all conditions. Call our nearest sales representative for speedy delivery.

WESTERN REPRESENTATIVES

Los Angeles	R. E. Cunningham & Son
San Francisco	Geo. E. Honn Co.
Seattle	Ken H. Best
Phoenix	J. E. Redmond Co.
Denver	R. F. Hamilton & Assoc.

THE R. THOMAS & SONS CO.
LISBON, OHIO

McKay, Veteran Engineer, Retires from PG and E

M. C. McKay, veteran construction engineer, has retired after 37 years with the Pacific Gas and Electric Co. His position as engineer of station construction has been filled by promotion of Arthur J. Swank, formerly assistant engineer, according to announcement by O. W. Peterson, head of the company's general construction department.

Swank is a graduate of the University of California in electrical engineering. While he was still in college he began his electrical utility training by working during vacation at PG and E substations and power houses. He entered the company's service in 1919.

McKay was first employed in 1897 with the Oakland Gas Light and Heat Co., which later became a part of Pacific Gas and Electric Co. He took this first job while he was finishing a course in electrical engineering at Van der Naillan School of Engineering. In 1903 he was resident engineer and had a hand in designing the power company plant at Lake Buntzen near Vancouver, B. C., at that time the largest hydroelectric installation in the West.

In 1913, on leave of absence from the Sierra and San Francisco Power company, he served as assistant to the chief of the department of electrical and mechanical engineering of the Panama Pacific International Exposition. Since 1923 he has been continuously a member of the general construction department's staff and has taken an important part in the building of many of PG and E's latest plant installations.

● Dr. Paul J. Raver, Bonneville power administrator, has been elected president of the Federal Business Assn. of Portland, an organization of heads and principal assistants of independently functioning federal executive activities.

● Earl McAlester, for some years prior to the war illuminating engineer for Pacific Gas and Electric Co. in San Rafael, has joined the Westinghouse Electric Supply Co., northern California district office, at San Francisco, as application engineer in lighting. He began as meter reader for PG and E in San Rafael in 1925; in 1935 he was appointed division commercial and industrial lighting representative for the north bay division. In 1943 he joined the Marinship organization and had charge of its permanent floodlighting, having previously taken charge of the dimout work. He later worked in the design section of the public works department at the Mare Island Navy Yard, and later in the electrical maintenance department.

John Riner now Purchasing Agent for Spokane Company

John A. Riner, formerly assistant general manager of Spokane United Railways, recently sold by Washington Water Power Co. to Spokane City Lines, has been appointed purchasing agent for the power company, it was announced early in July by J. E. E. Royer, vice-president and general manager. He succeeds the late Albert C. Haggenmiller.

At the same time it was announced that C. Rea Moore, Okanogan division manager of the company since 1931, has become head of the rates and economic research department. Moore started with the organization as a consulting engineer in 1930.

● F. C. (Cy) Bates, for the past three years the engineer on power supply and distribution for the Headquarters Ninth Service Command at Fort Douglas, Utah, resigned recently to join Westinghouse Electric Corp. in San Francisco.

For RELIABLE GROUND RESISTANCE TESTING . . .

VIBROGROUND

For measuring resistance of man-made grounds to earth. Are you sure of your ground connections? Could LIGHTNING damage your property because of inadequate grounding? Check ground connections periodically the VIBRO GROUND way. No cranking —Simple to operate.

Model 255

New TECHNICAL BULLETIN —Ground Resistance Measurement—Free—No obligation.

VIBROTEST—For insulation resistance testing in all fields. A complete line. Self-contained power supply.

Engineering Service Representatives in all principal cities.

ASSOCIATED RESEARCH, Incorporated

221—E. SOUTH GREEN STREET, CHICAGO 7, ILL.

For SAFETY'S sake . . . use CONDUIT

(Full Weight Rigid Steel)

WHEN steel conduit is available for general use again, you will want to rewire many of your wartime systems -- especially to replace substitute material in such critical places as these:

1. Where there is excessive vibration.
2. Where corrosion is a possibility.
3. Where there is moisture or vapor.
4. Where accumulating dust and dirt form a hazard.
5. Where there is danger of crushing or mechanical injury.

Standard-threaded full-weight rigid steel conduit affords the only sure protection against such hazards, because it has strength that endures. The most widely used rigid steel conduit, preferred by electrical contractors for its unvarying strength and durability, is YOUNGSTOWN BUCKEYE CONDUIT.

Above - This installation will last as long as the building itself stands, complete protection for complex wiring systems.

THE YOUNGSTOWN SHEET AND TUBE COMPANY
YOUNGSTOWN 1, OHIO
Manufacturers of
CARBON, ALLOY AND YOLOY STEELS

Ask your distributor for:
Youngstown Buckeye Conduit . . . Pipe and Tubular Products . . . Sheets . . . Plates . . . Tin Plate . . . Bars . . . Rods . . . Wire . . . Nails . . . Tie Plates and Spikes

EVERYTHING THAT T&B MAKES GOES ON HERE

For every possible kind of post-war hook-up for every type and size of wire and cable, and their raceways, T&B specializes in the fittings you require.

If your construction or production line job presents no unusual wiring problems, you will find standard T&B fittings are easy and quick to install and electrically and mechanically dependable.

If your job presents unusual problems, our design specialists will welcome the chance to design special fittings for the job. For this service we invite you to get in touch with our nearest T&B office listed below.

For supplies of T&B standard or special quality electrical fittings kindly order from your nearby T&B Wholesalers through whom all T&B products are distributed exclusively.

The Thomas & Betts Co., Incorporated
103 N. Santa Fe Avenue
Los Angeles 12, Calif.

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F. A. Strohecker
301 Eyres Bldg.
2207 First Ave., S.
Seattle 4, Washington

T&B
THE THOMAS & BETTS CO.
INCORPORATED
manufacturers of electrical fittings since 1898
ELIZABETH, 1, NEW JERSEY
In Canada: Thomas & Betts Ltd., Montreal

Puget Power Announces Sales Staff Changes

Appointment of Henry R. Kruse as general sales manager of Puget Sound Power & Light Co. was announced recently by President Frank McLaughlin, who at the same time stated that the department would be known in the future as the general sales department instead of the utilization department. Kruse had been manager of the department of economic development and research.

In the new set-up, Kruse will report directly to C. Patrick Johnson, vice-president. Reporting to Kruse will be Dr. George W. Allison, dealer sales promotion director, Ted Bakeman, director of industrial development, Emory C. Branch, commercial and industrial director, T. Karl Dimmitt, farm electrification director, Art Kramer, experimental laboratory director, and Mrs. Edith Rauch, home service director. K. E. Hollingsworth will be commercial sales supervisor and C. A. Scheyer industrial sales supervisor under direction of Branch.

Branch was transferred from Bellingham, where he had been northern division sales manager. His position there will be taken by A. B. Couch, formerly assistant sales manager for the central division.

Deaths

R. L. Dearborn

Robert Leland Dearborn took with him in death, June 25, the promise of an unique career in illuminating and electrical engineering. Only 34 years old, he had already ploughed new fields of research and shown such versatility and intellectual progress that it was grim irony a brain tumor cut short the fulfillment of his promise.

Born in Fairfield, Calif., in 1911, he worked in a local electrical store, became an electrician before entering Stanford in 1929. Family responsibilities prevented his completing work for his A.B. but, always a student, he read original papers in illumination and engineering, hoping to return to finish work for his degree. In 1935 he sold lighting equipment house to house for Pacific Gas and Electric, later worked as salesman for H. B. Squires Co. and Graybar. During this time he assisted A. W. Ray, superintendent of schools, Sausalito, in his searching studies into school illumination.

In 1938 he opened offices as consulting engineer and, with Hurford Sharon and William Wuelker, conducted experiments in equipment design. He designed lighting for a number of fair exhibits at the Golden Gate Exposition, made glare studies on the Bay bridge for the State Highway department, natural lighting studies for the California Department of Schoolhouse planning and other projects.

In 1941 Mr. Dearborn joined the Kaiser organization, designing illumination and electrical installation. He worked on such plants as the Permanente magnesium plant, Manteca, Moss Landing, Natividad DPC plants, Fontana steel plant and subsequent shell plants there and at Denver. When Kaiser Engineers was formed last year he was made a member of its permanent staff.

At the time of his death, following by three months a critical operation which had seemingly removed the tumor, he was chairman of the Northern California Section, Illuminating Engineering Society and a member of American Institute of Electrical Engineers.

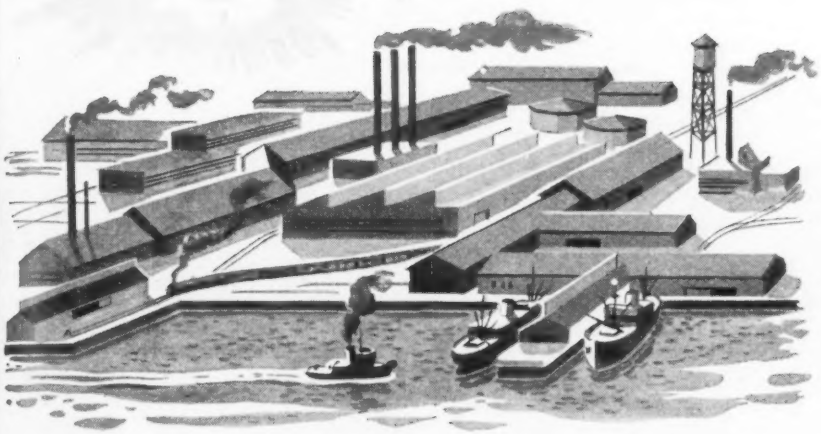
● Ray U. Muffley, central division sales manager for Puget Sound Power & Light Co., died June 21, following an extended illness. He started in the utility business with the Whatcom County Railway & Power Co., and became manager of its distribution department in 1912. From there he went to Seattle in 1923, as manager of the Washington Coast Utilities, and in 1924 was sent to Wenatchee as manager of Puget Sound Power & Light's eastern division. He returned to Seattle in 1927 as central division sales manager. He is a past president of the Seattle Electric Club.

● John A. Casey, for more than 37 years city electrical inspector of Walla Walla, Wash., died June 14. In 1931 he was president of the Northwestern Section, International Association of Electrical Inspectors and all his life, from the first year, 1926, never missed a meeting. He was born in Lapeer County, Mich., Sept. 4, 1886, came to Walla Walla in 1905 and joined the fire department. He was active in all local affairs.

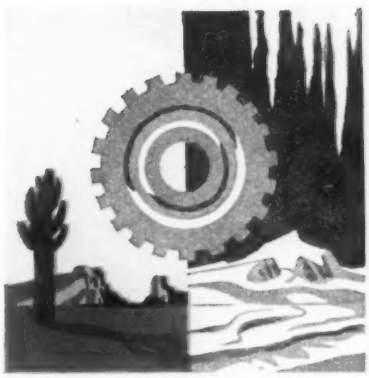
● Maynard P. Hotelling, city electrical inspector, Seattle, died in that city on June 29. He had been connected with the city building department for 22 years and was a long-time member of the Electric Club. He saw service in World War I as chief petty officer aboard a submarine.

● J. King Byron, Portland, managing director of the Retail Furniture Assn. of Oregon, died July 15. He had been active in community promotion of electric appliance campaigns in the regions of his association.

GREAT GREASE THAT'S HEATPROOF, WATERPROOF

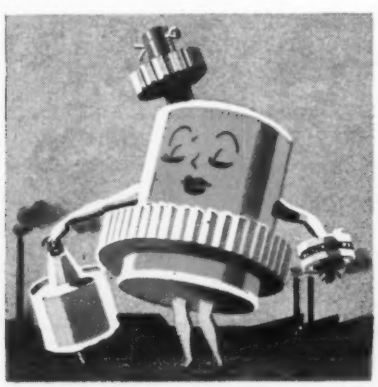


1. You can now get a grease that not only gives effective lubrication over a wide range in temperature but also has a high degree of resistance to moist air and water.

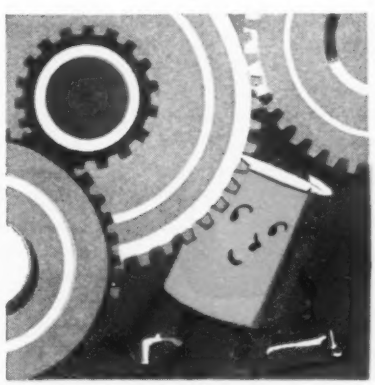


2. This great grease, UNOBA, was developed exclusively by Union Oil Company. It is made with a *barium* base, which gives it the exceptional heatproof and waterproof qualities.

3. In addition to these qualities, UNOBA has an unusual adhesiveness to metal and maintains excellent grease structure under severe mechanical working and does not deteriorate in storage.



4. This unique combination of properties qualifies UNOBA as an all-purpose lubricant, one capable of doing the jobs which previously required several different types, grades and brands.



5. UNOBA protects against rust, prevents excessive wear, and prolongs the life of engine and other equipment parts. Try some of this great grease. Your Union oilman will furnish full information and deliver a supply.

UNOBA

UNION 76

Another **UNION OIL** *Success-Tested Product*

NOW!
Telechron
MOTORS
are used on
Paragon
300
SERIES
TIME SWITCHES

● Telechron motors now bring a further improvement to Paragon 300 time switches . . . accurate, rugged, dependable units for controlling signs, commercial lights, attic fans, stokers, oil burners, blowers, pumps, valves, motors, etc. Rotor and gear train sealed to exclude dirt and dust. Two bearing plate construction. Lower power consumption. Sealed-in-oil reservoir. Other important features.

NO PRIORITY NEEDED

Government restrictions have been removed from time switches. They may be purchased without priority rating.

WRITE FOR NEW BULLETIN . . . giving complete details on the Telechron motored 300 series built by an organization of engineers and skilled craftsmen specializing in electrical equipment since 1905.

PARAGON ELECTRIC COMPANY
736 Old Colony Building • Chicago 5, Ill.

Paragon Chicago
BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1905

TRADE notes

● Webb Electric Co. has expanded and established a new downtown store in Portland at Southwest Fifth and Main Sts. Originally started at Oswego, a suburb of Portland, the original shop will still be retained there but the new store downtown will serve residential, commercial and maintenance customers. It is also planned to have a merchandise stock when available with water heaters, ranges, washing machines, dishwashers and other major appliances. The store is attractively lighted with built-in fluorescent lighting of the company's own manufacture. A repair shop is established on a balcony and the wiring department at the rear.

● A New Electrical Contracting firm, the Davies Electric Co., has opened San Diego offices at 327 W. E St., with William E. Davies, formerly of the Gill Electric Co., as owner. Davies has had more than 20 years of electrical contracting experience in San Diego. Company manager is Earl C. Myers, also formerly of Gill Electric. Myers has had 32 years of electrical contracting experience in the city. An experienced crew is now working in the field.

● Western Fiberglas Supply Ltd., San Francisco, has been appointed exclusive distribution agency in the eleven Western states for Bentley, Harris Mfg. Co.'s line of cotton and fiberglas varnished tubing and saturated sleeving. Western Fiberglas has established an electrical division, with Don Courtleigh as manager. Sales offices will be established in southern California and in the Pacific Northwest.

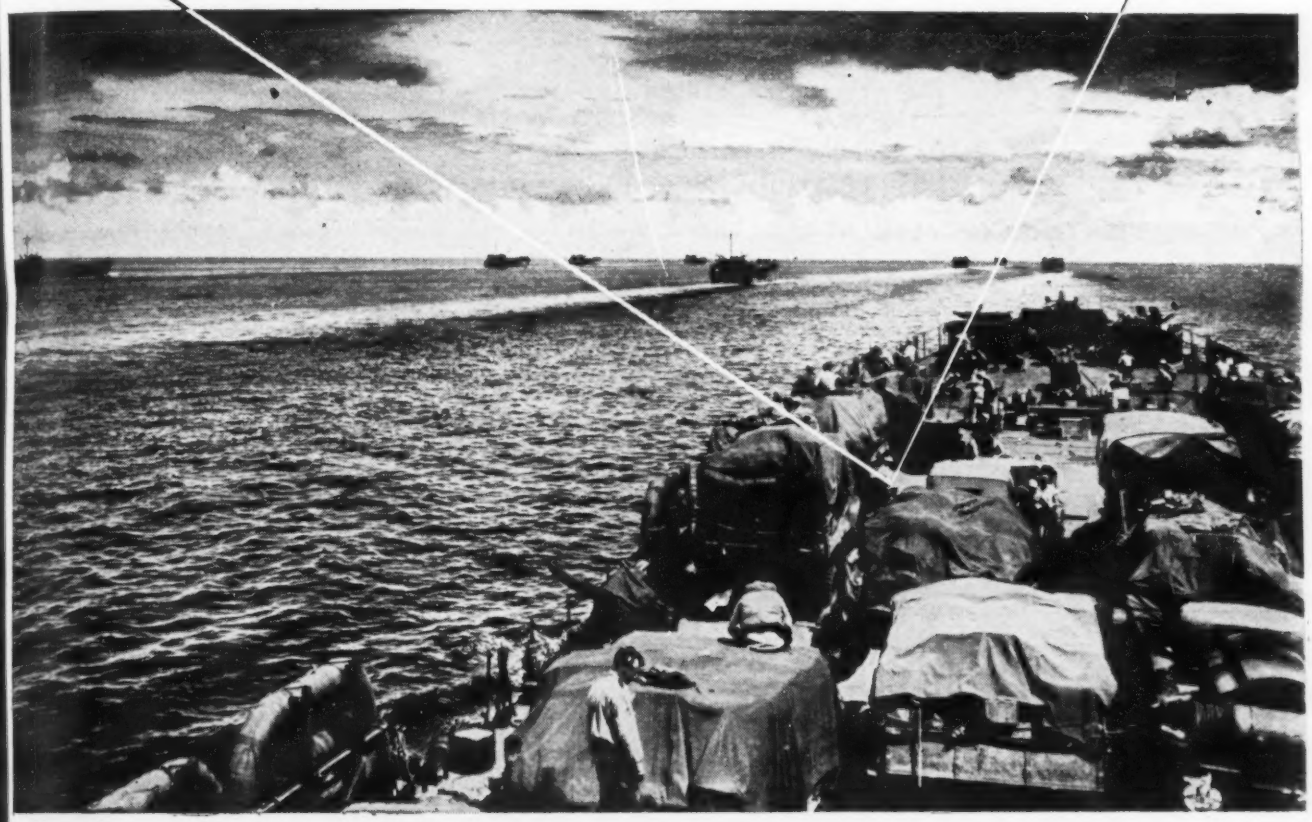
● Lamp License Agreements between General Electric Co. and Westinghouse Corp. have been cancelled. Under terms of the dissolution, which was effected by mutual agreement, each company has granted the other a non-exclusive and unrestricted license entitling each to use lamp patents owned and controlled by the other up to and including Aug. 1, 1945.

● Don Hopkins, who formerly managed the Incandescent Supply Co., Fresno branch, has opened a new wholesale electric supply house at 2330 Kern St., Fresno. Name of the organization is Electrical Suppliers. Stocks carried include appliances, lighting fixtures, lamps and wiring supplies.

● Pacific Public Service Co., of San Francisco has announced removal of its offices there from Standard Oil Building to 200 Bush St. The company controls Coast Counties Gas & Electric.

Celebrating its twenty-fifth anniversary in business in an unique public spirited way, California Electric Works, San Diego, brought in the mobile blood unit of the Red Cross and demonstrated how easy it is to give blood for the armed forces. Employees and their families participated, increasing the already fine record for such donations from this contracting company

On their Way again to Win again!



Are You?

Today the veterans of our European victories are sailing to final triumph in the Pacific! Meanwhile patriotic American industrial leaders are following a full-speed-ahead program to hasten peace through the Payroll Savings Plan!

From coast to coast, veteran Bond salesmen—and women—who put over the Mighty 7th, are once more mustered into service for plantwide selective resolicitation campaigns. These special efforts to keep employee Bond buying at a maximum are directed toward two major objectives:

A To hold every new 7th War Loan subscriber on the Payroll Savings Plan books—maintaining and, wherever possible, increasing present Bond allotments.

B To convince all regular subscribers who recently stepped up their Bond buying, of the many advantages of continuing on this foresighted, extra-Bonds-for-the-future basis.

Back up our fighting men who have won one war—and will win another. Use selective resolicitation to make your Payroll Savings Plan more effective—put a tighter rein on inflationary tendencies—build peacetime prosperity.

The Treasury Department acknowledges with appreciation the publication of this message by

ELECTRICAL WEST

★ *This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and War Advertising Council* ★

ECONOMICAL

Jeffries Transformers

Reasonable in Price
Reliable in Performance

Jeffries large transformers are priced reasonably—and you can save their first cost in a short time by minimizing current losses. When you use a Jeffries transformer, you can provide voltage change at the point desired, without prohibitive expense.

We supply all types and sizes. If not in stock, we build to order in a hurry—a week to 10 days.

Write today for catalog

JEFFRIES TRANSFORMER COMPANY
1710 E. 57th St. Los Angeles 11, Calif.

O.Z. TYPE EXE TYPE EX TYPE AX

EXPANSION FITTINGS

To compensate for the expansion and contraction of conduits terminating in a junction box, specify O. Z. Type "EXE".

For continuous runs of conduit provide for expansion and contraction by specifying O. Z. Type "EX". Expansion head is sealed against moisture by high grade packing. Interior Bakelite bushings prevent abrasion of cables.

Where a shorter and more compact fitting is required specify Type "AX" which incorporates the principles of the Type "EX" but has fewer parts.

For thin wall conduit (EMT) use our Type "TX". This is the same as the Type "AX" fitting except that it has extending nipples for attaching to thin wall couplings.

O. Z. ELECTRICAL PRODUCTS
- CONDUIT FITTINGS
- CABLE TERMINATORS
- JUNCTION BOXES
- SOLDERLESS CONNECTORS
- GROUNDING DEVICES
- POWER CONNECTORS

O.Z. ELECTRICAL MFG. CO.
262 BOND STREET · BROOKLYN, 2 N. Y.
REPRESENTATIVES IN PRINCIPAL CITIES

Represented by

ASSOC. SALES ENGINEERS . 324 No. San Pedro St., Los Angeles 12, Cal.
THE FRANK H. BRAN CO. . . . 904 Folsom St., San Francisco 7, Cal.
LEONARD S. FOLEY . . 131 South West 4th Ave., Portland 4, Oregon
C. A. KING CO. . . . . 2323 Second Ave., Seattle, Wash.

8144

● SAN DIEGO ELECTRIC Co., the building in which it has operated sold under it, has purchased property a block away and is erecting a new building, according to Bruno Barth, manager. Formerly at 733 Ninth St., the new building is at 633 Ninth St. It will have the same design, both of office and warehouse, but will have in addition a 50 x 50 yard. San Diego Electric has done considerable maintenance and construction work for the aircraft factories in the San Diego region.

● F. L. HOCKENSMITH SALES Co. announces that it has moved to new quarters from 443 S. San Pedro, Los Angeles, to 1262 S. Boyle, where additional warehousing facilities are available. Now handling Oceanic marine fittings, Cohardit insulated tools, B & F built-in electric bathroom heaters, Lake bells and the Hesse plater, other lines are to be added, according to Hockensmith.

● HOFFMAN ENGINEERING Co., manufacturers' representatives operating in Texas and Arizona, has moved its main office to Albuquerque, N. M. Lou Hoffman is manager. The firm has subdistributors in Tucson and Phoenix, Ariz., and Dallas, San Angele, Abilene, El Paso and Amarillo, Tex. Products handled include Allis-Chalmers, Allen Bradley, Delta Star and Standard Transformers.

● BART-KINNISON Co. has opened an office for the southern California, southern Nevada and Arizona trade in the Brockman Building, 7th and Grand, Los Angeles, according to D. J. Bartelme, owner. Lou L. Cogdell is manager of the Los Angeles office. Main office is Western Merchandise Mart, San Francisco.

● A COMPLETE LINE of radios and radio-phonograph combinations for marketing in West Coast trading area will be manufactured by Bendix Aviation Corp. at its Pacific division, it was announced recently by Palmer Nicholls, vice-president in charge of the division.

● SUNSET WHOLESALE ELECTRIC SUPPLY Co., 290 Ninth St., San Francisco, is a new wholesale supply house, operated by Art Landau and Fred Lampkin, who operated the Sunset Equipment Co., repair specialists, but will turn from repairs exclusively to wholesale supplies.

● AMONG THE ELECTRICAL DEALERS franchised by Westinghouse Electric Corp. to handle its postwar line of home appliances, including Laundromat refrigerators, ranges, ironers and the complete line, are the following: Barthel Hardware, Inc., 130 E. Broadway, Missoula, Mont., for seventeen years at that location, P. N. Barthel manager; Mead's at Manhattan, Mont., originally a variety store but dealing in electrical and radio appliances; J. H. Ackley Electric, South Bend, Wash., for twelve years at the present location, a contractor dealer; Montana Lumber & Hardware Co., Lewistown, Mont., Albert W. Gates, president.

● J. M. MONTGOMERY & Co. Inc., engineers of 306 W. Third St., Los Angeles, announced their appointment by the Defense Plant Corp. as managers of the Basic Magnesium project at Henderson, Nev. H. H. Gillings, former superintendent of maintenance, became general manager. Guernsey Frazer, administrative assistant during the operation of the plant, both by the original Basic Refractories Co. and later by Anaconda Copper Mining Co., remains as administrative assistant under the new management.

● WESTINGHOUSE has expanded its Denver maintenance and repair plant, installing new facilities and equipment. The stockroom has been rebuilt and arranged for easier handling of materials. New lathes, milling machines, jib cranes and dynamic balancing equipment have been installed.

Universal 8-pc. Tool Set, $14.85.....10 pc. $19.
Wrench Set, 6 pc. Box end, $7.85..Open end, $ 9.
Combination Box and Open 8 Wrench Set....$14.
Midget ¼" or ⅜" Socket Set in Case.....$19.
Standard ½" 15 pc. Socket Set and Case....$29.
Tractor ¾" 14 pc. Socket Set and Case.....$49.
Immediate Shipment—Clip Ad—Mail Check Now

UNIVERSAL TOOL CO.
1527 Grand EW Kansas City, Mo.

TORK CLOCKS

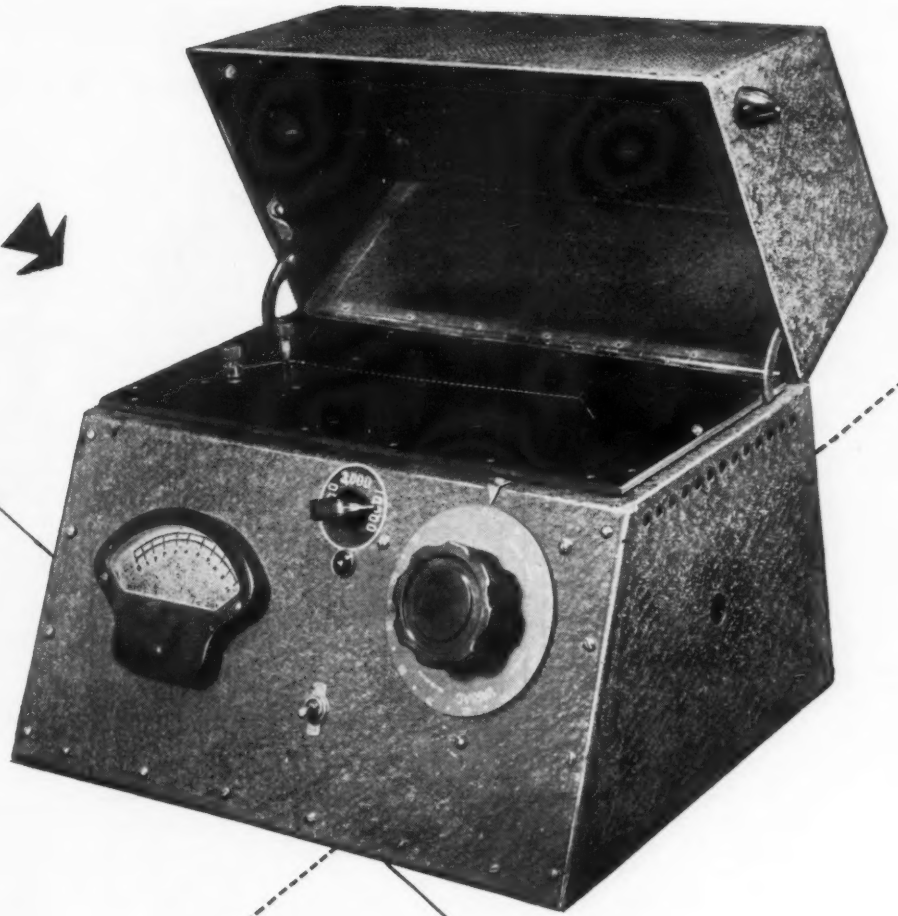
THE POPULAR TIME SWITCH LINE KNOWN EVERYWHERE

There is a Tork Clock for every regular switching job; 60 minute, 4 hour or daily cycles.

Bulletins on request

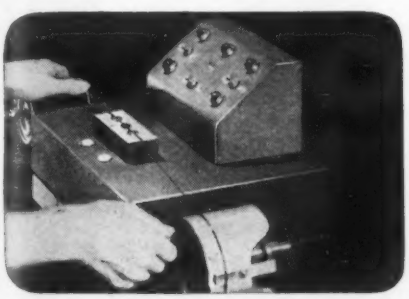
THE TORK CLOCK CO., Inc.
MOUNT VERNON, N. Y.

Western Representatives
A. R. Slimmon, 445 E. 3rd St....Los Angeles
Geo. H. Curtiss, 540 McAllister St.....S. F.
H. M. Sayers, 1101 Eastlake Ave.....Seattle
Stevens Sales Co., 41 P.O. Place, Salt Lake
Felix Simon, P.O. Box 614.....Denver
H. Geo. Shefler, P.O. Box 1587.....Phoenix



A LITTLE "POWER HOUSE"

that checks uniform enameling of Essex *EXTRA-TEST* Magnet Wire



Equally important, Essex Magnet Wire is spot checked each day by means of this mercury-bath test. Pin-hole breaks and film continuity are thus determined—enabling production engineers to maintain constant control of the variables which often cause poor insulating films.

Essex Magnet Wire from each day's run is subjected to severe dielectric tests in this little "power house"—operating range, 0 to 10,000 volts!

Two wires—twisted together to make a continuous-surface enamel film contact—are attached; then voltage is applied, and gradually increased until insulation fails. This automatically shuts off the machine, indicating exact voltage at which breakdown occurred.

Such tests enable Essex engineers to maintain close control of the enamel's desirable insulating characteristics—your assurance of safe, dependable insulation and maximum dielectric strength, when you specify Essex *Extra-Test* Magnet Wire for coil winding.

WIRE SX PRODUCTS

ESSEX WIRE CORPORATION

FORT WAYNE 6, INDIANA

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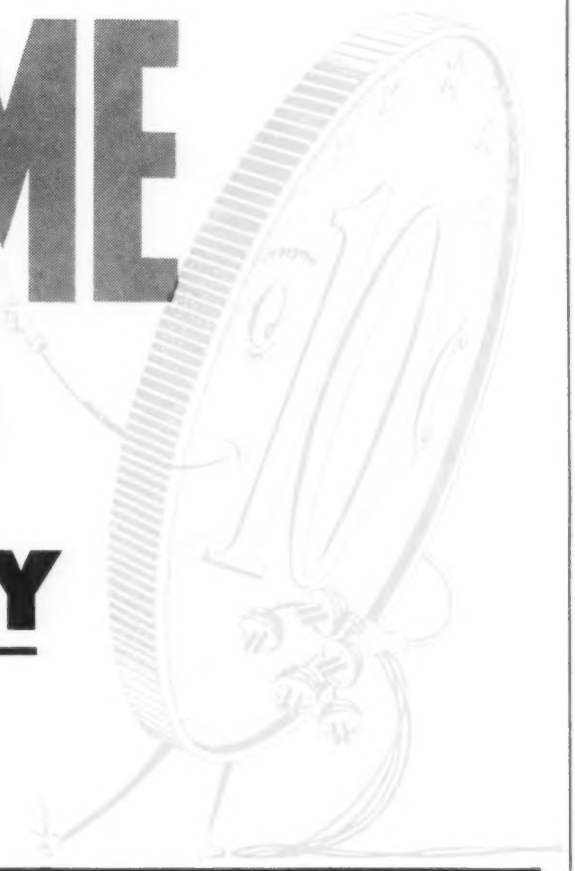
PROFILES *of the month*

Above, left, W. F. Smith, recently made Mountain States district manager for Line Material's field engineering division, with headquarters in Salt Lake City. Right, Bert Reynolds, now G-E Supply appliance sales manager, San Francisco district. He was with Pacific Gas and Electric for 17 years and was manager of domestic sales when he resigned to go with G-E Supply. Center, Ken Ryals, Stone Ryals Electric & Mfg. Co., San Francisco, recently elected president of the PCEA to succeed Hance Cleland, president of San Diego Gas & Electric. Below, the labor-management committee of Thermador Electrical & Mfg. Co., Los Angeles, one of the first Western electrical companies to establish such a plan. Pictured are: M. Booker, Dan Mayo, David Hoole, Clyde Harding, Harry Fogwell, W. E. Cranston, E. W. Lamb, Fred Pence, Clyde Coleman and Virgil Harris

ONE DIME

buys a lot of

ELECTRICITY



819,000 home users pay less than 10c a day for Electric Service

A dime... ten cents... won't buy much when you come to think of it. A cup of coffee? A piece of pie? A dime is pretty small money today! But your dime, the baby brother of a dollar, still gives man-size value when it buys ELECTRICITY. That is because electricity is still CHEAP today... 47 per cent cheaper than in 1914 while other principal living costs have risen more than 77 per cent.

P·G·and E·

PACIFIC GAS AND ELECTRIC COMPANY

A DIME'S WORTH OF ELECTRICITY WILL

TOAST 84 slices of bread.

BREW coffee a-plenty at mealtimes... 324 cups.

SWEEP with a vacuum cleaner some 80 room-size rugs.

WASH with a modern machine about 35 tubsfull of clothes.

LIGHT a 100-watt lamp for 33 hours.

RUN an electric clock for accurate time 42 days.

OPERATE your radio for total of 33 hours.

DO shirt-saving ironing 14 shirts.

Electricity Cost Has Gone DOWN and DOWN 47 per cent since 1914

EW 38X-845

LIGHT

LOAD BUILDER

★

BUSINESS BUILDER

Whether you are a utility company, a dealer or a manufacturer, we recommend Light as a postwar promoter and sustainer of profitable business. ★ Light is the universal need. ★ It is the first essential of factory operation—without adequate light the most carefully planned assembly line will not produce 100 per cent results. ★ It is the first essential in merchandising—who wants to buy goods he cannot see? ★ It is the first essential in offices, in homes—low visibility is a depressant and deterrent to your office workers just as it is a shroud for domestic comfort. ★ This is just a reminder to utility companies, to dealers and jobbers, to manufacturers, that your load building starts with LIGHT. ★ It is the foundation upon which sales volume is built.

PACIFIC COAST ELECTRICAL ASSOCIATION

601 WEST FIFTH STREET, LOS ANGELES ★ 447 SUTTER STREET, SAN FRANCISCO